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ANNUAL REPORT

Clemson University



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OF THE

COMMISSIONER OF FISHERIES

TO THE

SECRETARY OF COMMERCE

FOR THE

FISCAL YEAR ENDED JUNE 30, 1922



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BUREAU OF FISHERIES.

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HEADQUARTERS STAFF, 1921-22.

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*Bureau of Fisheries Document No. 913.*



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# REPORT OF THE COMMISSIONER OF FISHERIES.

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DEPARTMENT OF COMMERCE,  
BUREAU OF FISHERIES,  
*Washington, September 15, 1922.*

SIR: I have the honor to submit herewith a report of the operations of the Bureau of Fisheries during the fiscal year ended June 30, 1922.

## FISHERY INDUSTRIES SERVICES.

### REVIEW.

The period of extreme depression that affected the fisheries and fishery industries following the Great War appears to have passed, and indications of slow but gradual improvement are apparent. This change was little in evidence in 1921, the catch and the quantities preserved by various means generally being smaller than in 1920. For example, in the vessel fisheries at Boston and Gloucester, Mass., and Portland, Me., the landings of fresh and salted fish in 1921 amounted to 150,865,106 pounds, valued at \$5,722,629, a decrease of 27,415,595 pounds in quantity and of \$2,504,384 in value as compared with the previous year. In Alaska, the pack of canned salmon amounted to 2,596,826 cases, valued at \$19,632,744, a decrease of 1,832,637 cases in quantity and of \$15,970,056 in value as compared with 1920. The pack of sardines in Maine in 1921, amounting to 1,350,631 cases, valued at \$3,960,916, represents a decrease from the previous year of 527,126 cases in quantity and of \$3,474,140 in value. In California the total catch of all fishery products amounted to 127,728,623 pounds, a decrease of nearly 85,000,000 pounds as compared with 1920. The prices received for the products have materially declined, as indicated by the statistics given and as illustrated by the conditions obtaining in the vessel fisheries of the three New England ports mentioned. In 1916 the average price per pound received for these fish ex-vessel was 3.44 cents; in 1918, 5.12 cents; in 1921, 3.79 cents; and for the period January to June, 1922, inclusive, 3.26 cents. Reports emanating from European countries that have important fisheries indicate that their fisheries have been even more severely affected than our own.

While specific statistical data are not available for all lines for 1922, operations generally reflect a firmer tone in the market and canners and manufacturers of scrap and oil are proceeding with

considerable more assurance than during the preceding year. Reductions in transportation rates also have an important bearing on the situation.

The bureau has endeavored to render the industry all possible aid in coping with the difficulties encountered during this period, particularly along practical lines in merchandising and preservation of fishery products. Its trained personnel has given freely of its time in supplying suggestions and advice to those in the industry and in collecting for their use needful information covering practically every phase of the fishing industry. Its activities have included a series of highly valued market surveys of the following centers: Louisville, Ky., Pittsburgh, Pa., Chicago, Ill., Minneapolis and St. Paul, Minn., and Seattle, Wash. In the field of statistics, canvasses have been made of the fisheries of Maryland and Virginia for 1920, including the catch of shad and alewives in those States in 1921, and of the canning and by-products industries of the United States and Alaska in 1921, in addition to those of the landings of the vessel fisheries at the ports of Boston and Gloucester, Mass., Portland, Me., and Seattle, Wash., and statistical bulletins of cold-storage holdings of frozen fish have been issued monthly, beginning with the returns for January 15, 1922.

Fisheries technological investigations have included comprehensive investigations in net preservation, studies of refrigeration, including the freezing of fish in brine, and scientific studies of the principles involved in the processes of canning such fish as sardines.

#### FISH MERCHANDISING.

The field of fish merchandising affords many opportunities for helpful service to which the bureau is giving a larger measure of attention. The need for such service is reflected in the low per capita consumption of fish in this country, in the difficulties encountered by the producers in finding outlets for their catch of fish with existing equipment of capture, and in the low prices received by them for the products of their labor. The producers are fully aware of the need of effecting improvements in the distribution of fresh and frozen fish as indicated by the interest shown in precooling of fish in brine, and in preparing the fish for the convenience of the housewife, as by filleting and by wrapping the individual fish in parchment paper.

#### MARKET SURVEYS.

Market surveys of certain large distributing centers for fresh and frozen fish, initiated in June, 1921, at Louisville, Ky., were continued through the greater part of the year by surveys of Pittsburgh, Pa., Chicago, Ill., Minneapolis and St. Paul, Minn., and Seattle, Wash., the results of which have been published as Economic Circulars Nos. 52, 54, 55, and Document No. 930, respectively.

The supply of fresh and frozen fishery products reaching Pittsburgh, Pa., is derived chiefly from the Great Lakes, the west coast from Seattle to Prince Rupert, and the Atlantic coast from New York to Boston. Halibut from the Pacific coast is the most important single species sold in Pittsburgh. Other species of importance, which with halibut constitute about 75 per cent of the



trade, are blue pike, ciscoes, cod, sauger, whitefish, yellow pike, and shucked oysters. At the time the survey was made 71 firms were engaged in the fish business. Five of the firms were in the wholesale trade exclusively and six in both the wholesale and retail trades. In the retail stores ice was used in conjunction with all displays, of which 86 per cent were made in inclosed cases covered with glass or other protective materials.

The bulk of Chicago's supply of fresh and frozen fish is derived from the Great Lakes, the North Pacific coast, and lakes in the Dominion of Canada. During the year ended July 31, 1921, 526 carloads of fresh and frozen fish, exclusive of oysters, were received from the Dominion of Canada, as compared with 272 from the United States. During the same period 195 carloads of oysters were received and 422 express carloads of fish passing through Chicago from northern and western points, consigned to points in the East and South, were opened and partially unloaded en route by local dealers. Of the 81 different species marketed in Chicago approximately 70 per cent of the trade is confined to but 11, namely, buffalo fish, carp, ciscoes, whitefish, lake trout, salmon, pike or "jacks," yellow perch, "yellow pike" (pike perch), halibut, and shucked oysters. The fishery products are handled either exclusively or as major commodities, compared with other foods, by 222 Chicago firms, of which 56 are in the wholesale business exclusively. In addition there are several thousand butcher, grocery, and delicatessen stores that handle fish as a side line on Fridays.

Minneapolis and St. Paul receive their supplies of fish mainly from lakes in the Canadian Provinces of Manitoba and Alberta, Lake Superior, near-by rivers and small lakes, and the North Pacific coast from Seattle to Prince Rupert. About 90 per cent of the sales of fresh and frozen fishery products consists of "yellow pike" or pike perch, halibut, salmon, lake trout, whitefish, ciscoes or "lake herring," and shucked oysters. During the year ended September 30, 1921, 5,142,783 pounds of frozen fish, of which 3,629,713 pounds are credited to Minneapolis, were placed in public cold-storage warehouses in these two cities.

As a distributing center for fresh and frozen fishery products Seattle is the most important on the Pacific coast and as a fishing port is exceeded in the United States only by Boston and Gloucester, Mass. The quantity of fresh and frozen fish received during 1921 amounted to over 45,000,000 pounds, of which 63 per cent was re-shipped in the fresh or frozen condition for consumption in other cities. Of the carload shipments 92 per cent was consigned to points east of Omaha, Nebr., and less-than-carload shipments were confined largely to cities west of Omaha. Salmon and halibut constitute the backbone of the trade, the combined landings of these two species during 1921 constituting over 83 per cent of all fresh and frozen fishery products reaching this market. Fishing areas off the coast of Oregon, Washington, British Columbia, and Alaska, together with Puget Sound, constitute the principal areas of supply. Fish-freezing establishments located in Seattle froze in excess of 12,000,000 pounds of fish during 1921 and received over 2,000,000 pounds already frozen. Withdrawals during this period amounted to 14,077,007 pounds, of which 6,209,562 pounds were halibut and 6,137,484 pounds salmon.

## TECHNOLOGICAL INVESTIGATIONS.

Such important investigations as have been undertaken in this field are of necessity time consuming and require a considerable investment. It has been the policy of the bureau to center its activities on a limited number of such problems that promise important benefits to the greatest possible number in the industry when brought to a successful end. To make satisfactory progress in these fields of endeavor with the limited personnel and funds available necessitates close adherence to this program and avoidance wherever practicable of undertaking minor investigations for which there may be some demand. The bureau regrets the necessity of making such limitations, but deems it the wiser course to pursue under present handicaps. The major technological investigations in progress are in the fields of net preservation, canning, and refrigeration, including freezing in brine.

## PRESERVATION OF FISHING NETS AND LINES.

During the year excellent progress has been made in the investigation on the preservation of nets, including tests of the value of various net preservatives, increase in weight of the net by the addition of the various preservatives, shrinkage, breaking strength, wearing quality, relative stiffness of lines when treated with the various preservatives in comparison with the untreated line, etc. Attention has also been given to the development of an improved preservative for nets. A large series of lines has been placed in the water at a number of places for protracted periods, sets being taken up and subjected to various tests at regular intervals. Such investigations will be completed in the near future, and a report on the results thus far attained will be prepared for the use of the trade as promptly as practicable.

## CANNING OF FISHERY PRODUCTS.

A study of the changes that take place in the oil used for frying sardines, conducted at San Pedro, Calif., has been concluded and the results published.<sup>1</sup>

In view of certain difficulties attending the frying of sardines in oil, it was deemed advisable to attempt to develop a method of packing that would eliminate the use of the fry bath and that might be economically employed by such as wished to change their process. Work along these lines is being continued. The preparation of sardines for canning is largely a problem of removing excess water from the fish. Frying in oil, steaming, and cooling in brine, are aids to the accomplishment of this end. In the trials made, the best results accrued from removing the excess water by thorough brining and drying, followed by packing the fish raw and depending upon subsequent processing to cook them. From an economic point of view the process appears to possess some merit. Storage and shipping tests are in progress.

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<sup>1</sup> Changes in Oil Used for Frying Sardines, by Harry R. Beard, State of California Fish and Game Commission Circular No. 1, March, 1922, Sacramento, Calif.



## FREEZING OF FISH IN BRINE.

The possibilities of freezing fish in brine continue to attract much attention, both in this country and abroad. To meet demand the bureau has issued an economic circular giving a review of the subject. This report calls attention to means of properly glazing fish frozen in brine and stresses the point that the most important aspect of brine freezing awaiting development is its practical application on a large scale.

## BRAZILIAN INTERNATIONAL CENTENNIAL EXPOSITION.

According to a joint resolution of Congress accepting the invitation of the Republic of Brazil to take part in an international exposition to be held in Rio de Janeiro in 1922, the Secretary of Commerce is "authorized to collect and prepare a suitable exhibit of the fisheries industry of the United States for exhibit at the said exposition and accompany the same with a report respecting such industry, to be printed in the English, Spanish, and Portuguese languages." As the United States commission to the exposition allotted but 900 square feet of floor space and less than \$5,000 for the assembling of the exhibit in Washington, D. C., the exhibit has of necessity been small. It is educational in character, showing the relationship of the Federal Government to the fisheries, the diversity and character of our fisheries and fishery products, possibilities of American markets as a source of raw materials required in the fishing industry, and opportunities for acquiring industrial education afforded those who may wish to specialize in this field. The exhibit includes displays representing the New England offshore fisheries, the salmon industry, the sardine industry of Maine and California, the oyster industry, the fresh-water mussel industry, the fish-canning industry, by-products of the fisheries, and an illustrated story of the bureau's organization and activities. The report deals with the fisheries of the United States, the organization and functions of the bureau, and the opportunities afforded students of fisheries in the United States to acquire industrial education in this field. The bureau is allowed but a single representative at the exposition, which is scheduled to open September 7, 1922, and close March 31, 1923.

## CANNED FISHERY PRODUCTS AND BY-PRODUCTS.

The bureau has made a canvass of the canned fishery products and fishery by-products industries of the United States and Alaska for the year 1921. The total value of the fishery products canned during the year was \$46,634,706, and the value of the fishery by-products prepared, such as fish oil, fertilizer, liquid glue, poultry grit, and lime, was \$8,351,827. The results of the canvass were published and distributed to the trade as Statistical Bulletin No. 526.

The pack of canned salmon, reduced to the equivalent of 48 pounds of fish to the case, amounted to 3,599,774 cases, valued at \$28,867,169, of which 2,596,826 cases, valued at \$19,632,744, were packed in Alaska, and 1,002,948 cases, valued at \$9,234,425, in the Pacific Coast States. Other canned-salmon products, valued at \$69,170, were also prepared.

The pack of sardines in Maine in 1921 amounted to 1,350,631 cases, valued at \$3,960,916, compared with 2,450,268 cases, valued at \$11,933,986, in 1919, and 1,877,757 cases, valued at \$7,435,056, in 1920. The pack of sardines in California in 1921 was 415,587 cases, valued at \$2,346,446, compared with 1,150,616 cases reported for 1919, and 1,062,996 cases reported for 1920.

The canning of shad is confined to the States of Oregon and Washington. The pack of shad in 1921 amounted to 841 cases, valued at \$2,455, and of shad roe to 53 cases, valued at \$142. These products are packed in half-pound flat, half-pound oval, and 1-pound tall cans with 48 cans to a case.

The pack of canned alewives and alewife roe in 1921 was prepared in Maryland, Virginia, and North Carolina. The pack of alewives amounted to 312 cases, or 8,976 cans, valued at \$813; and of roe to 40,530 cases, or 1,197,288 cans, valued at \$157,841.

The pack of canned albacore in California in 1921 amounted to 344,117 cases, valued at \$2,657,266; the pack of canned tuna to 74,704 cases, valued at \$416,415; and of canned mackerel to 2,255 cases, valued at \$12,275; a total of 421,076 cases, valued at \$3,085,956. These products were packed in cans of various sizes with 48 cans to a case.

In 1921 shrimp were canned in Louisiana, Mississippi, Alabama, Florida, Georgia, and North Carolina, the pack amounting to 667,558 cases, with a value of \$3,804,781. Louisiana led with a pack of 273,218 cases, valued at \$1,530,072, or 40 per cent of the total value of the pack. Mississippi ranked second with 169,751 cases, valued at \$958,268. The bulk of the pack is put up in No. 1 cans, four dozen to the case, representing 597,474 cases, valued at \$3,407,977. Smaller quantities were packed in No. 1½ and No. 2½ cans, two dozen to the case, and No. 10 cans, one-half dozen to the case.

Crabs were canned at two plants in Virginia, two in Alaska, and one each in Washington and Louisiana, the pack amounting to 11,960 cases, valued at \$115,800.

In 1921 the pack of razor clams, confined to Oregon, Washington, and Alaska, amounted to 92,085 cases, valued at \$509,122, and included whole and minced clams and clam juice. The pack of hard clams, confined to Florida and Washington, amounted to 46,207 cases, valued at \$212,846, and included whole and minced clams, clam bouillon, chowder, and juice. The pack of soft clams, confined to Maine and Massachusetts, amounted to 87,838 cases, valued at \$444,539, which included whole clams, clam bouillon, chowder, and extract. The total pack of clams produced was 226,130 cases, with a value of \$1,166,507.

In 1921 oysters were canned in Maryland, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, and Louisiana, the pack amounting to 455,550 cases, valued at \$2,179,271. Maryland outranked the other States with a pack of 156,431 cases, valued at \$778,435, Mississippi being second with a pack of 143,938 cases, valued at \$699,405.

In 1921 there were 39 factories engaged in the reduction of menhaden, utilizing 1,031,540,831 fish, or 618,924,499 pounds, valued at \$1,929,219. The yield of scrap and meal was 82,662 tons, valued at \$2,286,095, and of oil, 6,260,478 gallons, valued at \$1,719,892, the total value of the products amounting to \$4,005,987.



The total production of fish oils in 1921 (including menhaden) in the United States and Alaska amounted to 7,446,281 gallons, valued at \$2,078,670. The production of the various oils were as follows: Menhaden oil, 6,260,478 gallons; whale oil, 354,372 gallons; herring oil, 283,815 gallons; sperm oil, 168,729 gallons; salmon oil, 71,522 gallons; cod and cod-liver oil, 49,772 gallons; and miscellaneous fish oils, 257,593 gallons.

The production of fish (including menhaden) and whale scrap and meal and shrimp bran in 1921 amounted to 107,273 tons, valued at \$3,557,142. The production of dried scrap and meal was 60,031 tons, valued at \$2,613,361; of acidulated scrap, 44,454 tons, valued at \$895,140; of crude or green scrap, 2,160 tons, valued at \$31,827; and of shrimp bran, 628 tons, valued at \$16,814. The production in the Atlantic and Gulf States amounted to 89,559 tons, and in the Pacific coast States and Alaska to 17,714 tons. Although it is impracticable to obtain definite figures as to the quantities of fish meal used for feeding purposes, it is evident that the demand for this commodity is rapidly increasing, particularly on the Atlantic seaboard.

In 1921 there were 54 plants engaged in grinding oyster shells for the production of poultry grit and lime, the yield of which amounted to 259,238 tons, valued at \$2,261,754, of which 185,474 tons, valued at \$1,759,120, were poultry grit.

Other by-products of the fisheries included fish glue, shark and porpoise hides, agar-agar, pearl or fish-scale essence, shark fins, whale bones (skeletons) and whale tails, to the value of \$154,261.

#### FROZEN-FISH TRADE.

Statistics of the cold-storage holdings of frozen fish have been collected and published by the Bureau of Markets, Department of Agriculture, beginning with October, 1916. These reports give the holdings on the fifteenth day of the current month. Through the courtesy of that bureau arrangements were made in December, 1921, for the Bureau of Fisheries to publish and disseminate this information, beginning with the returns for January 15, 1922, in the form of a monthly statistical bulletin. This bulletin gives the holdings by species and sections, total holdings for the current month and for the same month of the previous year, the five-year average, holdings for the previous month, and the quantity of each species frozen during the month.

The quantity of fish frozen between December 15, 1920, and December 15, 1921, according to these statistics, was 79,173,892 pounds, as compared with 93,973,589 pounds the previous year. The principal species and quantities frozen during the year ended December 15, 1921, were halibut, 10,773,803 pounds; salmon, 10,033,619 pounds; herring, 9,827,671 pounds; ciscoes, 8,649,315 pounds; whiting, 5,527,047 pounds; and miscellaneous fishes, 14,436,657 pounds.

#### SMOKED-FISH INDUSTRY OF MAINE.

In 1921 there were 28 firms engaged in smoking fishery products in Maine, exclusive of a few individuals smoking small quantities of alewives, as compared with 50 firms in this industry in 1919. The

smoked products included 2,111,206 pounds of herring, valued at \$189,653; 471,205 pounds of finnan haddie, valued at \$67,105; and 42,333 pounds of alewives, valued at \$2,925; a total of 2,624,744 pounds, valued at \$259,683. Compared with 1919, there has been a decrease in the smoked-fish products prepared in the State of 41 per cent in quantity and 50 per cent in value.

#### NEW ENGLAND VESSEL FISHERIES.

The bureau, through its local agents, has collected detailed statistics of the vessel fisheries at Boston and Gloucester, Mass., and Portland, Me., which have been published in monthly and annual statistical bulletins. Two annual bulletins have been issued, one showing the catch by months, the other by fishing grounds. There was a decrease in the number of trips and also in the quantity and value of the products landed at these ports during the year as compared with the previous year. At Portland there was a small increase in the number of trips and in the quantity of products landed, but a decrease in the value.

The fishing fleet at these ports during the calendar year 1921 numbered 398 sail, steam, and gasoline screw vessels, including 23 American and 3 Canadian steam trawlers. These vessels landed at Boston 3,078 trips, aggregating 104,368,629 pounds of fish, valued at \$4,190,135; at Gloucester, 2,073 trips, aggregating 33,016,166 pounds, valued at \$920,250; and at Portland 2,055 trips, aggregating 13,480,311 pounds, valued at \$612,244. The total for the three ports amounted to 7,206 trips, aggregating 150,865,106 pounds of fresh and salted fish, having a value to the fishermen of \$5,722,629.

The foregoing total includes 72 trips, 49 at Boston, 7 at Gloucester, and 16 at Portland, landed by 22 Canadian fishing vessels, amounting to 4,222,319 pounds of fish, valued at \$127,549. Of this quantity, 1,849,702 pounds, valued at \$65,388, were landed at Boston; 239,209 pounds, valued at \$8,409, at Gloucester; and 2,133,408 pounds, valued at \$53,752, at Portland. There was an increase of 4 vessels and 18 trips, and of 1,634,101 pounds in quantity and \$8,521 in value of fish landed as compared with the previous year. These fish were landed in accordance with an arrangement with the Canadian Government as an emergency war measure granting reciprocal privileges to fishing vessels, by which Canadian fishing vessels were permitted to land their fares at American ports direct from the fishing grounds. Canadian vessels began to utilize this privilege in April, 1918, and the arrangement was canceled to take effect July 15, 1921, but a number of trips were admitted after that date, the last one being landed in September.

Compared with the previous year, there was a decrease of 400 trips, or 5.25 per cent, in the total number landed by the fishing fleet at Boston, Gloucester, and Portland, and of 27,415,595 pounds, or 15.37 per cent, in quantity and of \$2,504,384, or 30.44 per cent, in the value of the products landed. The only important species showing an increase in both quantity and value was halibut. The catch of halibut increased 1,876,698 pounds, or 49.52 per cent, in quantity and \$61,253, or 8.25 per cent, in value. The catch of cusk increased 243,676 pounds, or 13.13 per cent, in quantity but decreased \$10,241,



or 21.30 per cent, in value. There was a decrease in both quantity and value of the catch of all the other more important species. The catch of cod decreased 8,750,568 pounds, or 14.05 per cent, in quantity and \$906,870, or 34.38 per cent, in value; haddock, 7,866,768 pounds, or 10.45 per cent, in quantity and \$693,882, or 25.32 per cent, in value; hake, 185,248 pounds, or 3.92 per cent, in quantity and \$44,273, or 28.77 per cent, in value; pollock, 1,615,890 pounds, or 18.87 per cent, in quantity and \$97,486, or 37.19 per cent, in value; mackerel, 3,909,541 pounds, or 53.60 per cent, in quantity and \$427,468, or 56.01 per cent, in value; herring, 4,384,444 pounds, or 62.65 per cent, in quantity and \$125,894, or 75.70 per cent, in value; and swordfish, 934,024 pounds, or 36.89 per cent, in quantity and \$175,796, or 35.57 per cent, in value. The catch of Newfoundland herring declined from 3,097,024 pounds, valued at \$110,157, in 1920, to 551,400 pounds, valued at \$19,584, in 1921. In the various other species combined there was a decrease of \$1,889,486 pounds, or 37.89 per cent, in quantity and of \$83,727, or 38.08 per cent, in value.

The catch of cod, haddock, and hake is sold in different grades as landed from the vessels. Cod are sold as large, market, and scrod; haddock, as large and scrod; and hake, as large and small. The quantity of scrod cod and scrod haddock is very small as compared with that of the other grades of these species, said to be due to the fact that the price received is so low that the fishermen do not save all that are caught. The catch of scrod cod landed at these ports during the year was 1,150,577 pounds, valued at \$10,844, and of scrod haddock only 30,562 pounds, valued at \$535.

The fishery products landed at Boston, Gloucester, and Portland by fishing vessels each year are taken principally from fishing grounds off the coast of the United States. In the calendar year 1921, 85.39 per cent of the quantity and 77.99 per cent of the value of the catch landed by American and Canadian fishing vessels at these ports were from these grounds; 4.08 per cent of the quantity and 7.32 per cent of the value, consisting chiefly of cod, halibut, and herring, were from fishing banks off the coast of Newfoundland; and 10.51 per cent of the quantity and 14.67 per cent of the value from fishing grounds off the Canadian Provinces. There was considerable falling off in the percentage of products from grounds off the Canadian Provinces, but an increase in that from grounds off the United States and Newfoundland compared with the previous year. Newfoundland herring constituted less than one-half of 1 per cent of the quantity and value of the fishery products landed at these ports during the year. The herring were taken from the treaty coast of Newfoundland, and the cod, haddock, hake, halibut, and other species from that region were obtained from fishing banks on the high seas. All fish caught by American fishing vessels off the coast of the Canadian Provinces were from offshore fishing grounds.

Haddock ranked first in both quality and value in the vessel fisheries at these ports in 1921, the catch amounting to 67,412,709 pounds, valued at \$2,046,170, all landed fresh except 15,290 pounds salted, valued at \$182. The catch of cod was 53,515,014 pounds, valued at \$1,730,767, including 5,408,768 pounds salted, valued at \$217,310. The catch of hake was 4,536,108 pounds, valued at \$109,603, all landed fresh except 42,233 pounds salted, valued at

\$765. More than half of the catch was landed at Boston. The catch of pollock amounted to 6,945,011 pounds, valued at \$164,642, all landed fresh except 51,992 pounds salted, valued at \$913. The catch of cusk was 2,098,415 pounds, valued at \$37,829, all landed fresh except 38,433 pounds salted, valued at \$781. The catch of halibut was 5,666,028 pounds, valued at \$803,074, all landed fresh except 48,431 pounds salted, valued at \$7,076. There was an increase in the halibut catch of 1,876,698 pounds in quantity and \$61,253 in value as compared with the previous year. The catch was the largest taken in the past six years. The quantity landed at Boston was 3,808,468 pounds, valued at \$556,592; at Gloucester, 433,361 pounds, valued at \$46,510; and at Portland, 1,424,199 pounds, valued at \$199,972. The catch of swordfish was 1,597,645 pounds, valued at \$318,406; and of flounders, 2,604,657 pounds, valued at \$111,956. The catch of herring amounted to 2,613,540 pounds, valued at \$40,407. Of this quantity, 2,062,140 pounds, valued at \$20,823, were taken off the coast of the United States and landed fresh; and the remainder, including 200,000 pounds fresh, frozen, valued at \$10,000, and 351,400 pounds salted, valued at \$9,584, were Newfoundland herring.

The total catch of fresh mackerel taken by the American fishing fleet in 1921 was 40,323 barrels, compared with 79,799 barrels in 1920, a decrease of 39,476 barrels. The total catch of salted mackerel was 3,242 barrels, compared with 4,897 barrels in 1920, a decrease of 1,655 barrels. The quantity of mackerel landed at Boston, Gloucester, and Portland by the fishing fleet in 1921 was 3,384,180 pounds, valued at \$335,626, of which 2,734,680 pounds, valued at \$290,164, were fresh, and 649,500 pounds, valued at \$45,462, were salted.

In 1922 the total catch of mackerel up to July 1 was 25,000 barrels fresh and 2,344 barrels salted, compared with 33,632 barrels fresh and 3,143 barrels salted for the same period in 1921. In the southern mackerel fishery both the purse-seine vessels and the gill-net vessels had a poor season. The weather was favorable for fishing, but the mackerel were not abundant. The fish landed were practically all of large and medium size and sold from 9 to 30 cents per pound, according to market conditions. The first mackerel landed sold at 60 cents per pound. The southern mackerel fleet was about the same size as in the previous year. The Cape Shore fleet was larger than last year but less successful. The first arrival was on May 25 and consisted of large and medium fish, which sold at 18.6 cents per pound. On June 2, fresh mackerel sold at 6½ cents per pound from the vessel, the lowest price since 1919. Cape Shore salted mackerel sold from \$12 to \$13 per barrel.

#### VESSEL FISHERIES AT SEATTLE, WASH.

Statistics of the vessel fisheries at Seattle, Wash., have been collected by the local agent and published as monthly and annual statistical bulletins, giving the quantity and value of fishery products landed by American fishing and collecting vessels during the year at that port.

The fishing fleet at Seattle, in 1921, landed 866 trips, amounting to 13,666,700 pounds of fish, having a value to the fishermen of \$1,423,303, from fishing grounds along the coast from Oregon to Portlock



Bank, Alaska. The largest quantities were taken from Flattery Banks, west coast of Vancouver Island, and Hecate Strait. The products included halibut, 11,481,000 pounds, valued at \$1,335,658; sablefish, 1,519,400 pounds, valued at \$63,685; "lingcod," 463,300 pounds, valued at \$16,391; and rockfishes, 203,000 pounds, valued at \$7,569. Compared with the previous year there was an increase of 44 trips by fishing vessels, but a decrease of 688,750 pounds, or 4.79 per cent, in the quantity and of \$569,456, or 28.57 per cent, in the value of the products. There was a decrease in the catch of halibut of 1,202,450 pounds, or 9.48 per cent, in quantity and of \$578,191, or 30.21 per cent, in value. The catch of "lingcod" decreased 49,735 pounds, or 9.69 per cent, in quantity and \$4,762, or 22.51 per cent, in value; and the catch of rockfishes decreased 5,765 pounds, or 2.76 per cent, in quantity and \$225, or 2.88 per cent, in value. There was an increase in the catch of sablefish of 569,200 pounds, or 59.90 per cent, in quantity and of \$13,722, or 27.46 per cent, in value.

The fishery products taken in Puget Sound and landed at Seattle by collecting vessels during the year amounted to 12,428,525 pounds, valued at \$778,878. This quantity included 10,349,700 pounds of salmon, valued at \$679,171, and the remainder consisted of herring, steelhead trout, smelt, perch, rockfishes, "lingcod," flounders, sole, and crabs. Compared with the previous year, there was an increase in the products landed by collecting vessels of 2,614,559 pounds, or 26.64 per cent, in quantity, but a decrease of \$102,188, or 11.59 per cent, in value.

#### FISHERIES OF CALIFORNIA.

Through the courtesy of the California Fish and Game Commission, the bureau has received statistics of the catch of fish taken in the waters of that State by species and localities for the calendar year 1921. The catch taken during the year amounted to 127,728,623 pounds, as compared with 212,635,075 pounds the previous year, a decrease of 84,906,452 pounds, or 39.93 per cent. The principal species were pilchards, 59,332,305 pounds; albacore and tuna, 19,831,680 pounds; flounders, 8,429,595 pounds; salmon, 7,990,932 pounds; rockfishes, 4,641,156 pounds; barracuda, 4,588,900 pounds; mackerel, 2,914,613 pounds; yellowtail, 2,139,626 pounds; white sea bass or squeteague, 2,069,544 pounds; anchovies, 1,946,881 pounds; abalones, 1,481,170 pounds; bonito or skipjack, 1,376,712 pounds; sablefish, 1,022,556 pounds; and shad, 862,897 pounds. Compared with 1920, the catch of pilchards decreased 59,185,424 pounds, or 49.93 per cent; albacore and tuna, 16,312,660 pounds, or 45.13 per cent; and bonito or skipjack, 7,237,869 pounds, or 84 per cent. There was an increase in the catch of anchovies of 1,376,195 pounds, or 241.15 per cent, and in the catch of sablefish of 241,524 pounds or 30.92 per cent.

The imports of fresh fish from Mexico in 1921 amounted to 6,699,817 pounds, as compared with 8,121,225 pounds the previous year. The principal species imported were barracuda, 3,036,262 pounds; flounders, 1,314,918 pounds; sea crawfish or spiny lobster, 943,547 pounds; and white sea bass or squeteague, 500,075 pounds.

#### FISHERIES OF MARYLAND AND VIRGINIA.

A canvass of the fisheries of Maryland and Virginia for the calendar year 1920 was completed the latter part of 1921, and the results

were published in condensed form as Statistical Bulletin No. 520 early in 1922, and distributed to the trade.

The number of persons engaged in the fisheries of Maryland was 21,383, the investment was \$7,566,434, and the products amounted to 59,530,795 pounds, with a value to the fishermen of \$4,198,668. The principal species were oysters, 4,547,471 bushels, or 31,832,297 pounds, exclusive of shells, valued at \$2,291,120; crabs, 27,188,922 in number, or 9,062,974 pounds, valued at \$742,944; shad, 1,867,196 pounds, valued at \$355,217; striped bass, 1,040,274 pounds, valued at \$193,295; alewives, fresh and salted, 7,073,688 pounds, valued at \$177,240; squeteague or "sea trout," fresh and salted, 2,281,490 pounds, valued at \$92,284; and croaker, 2,519,770 pounds, valued at \$66,576. Compared with 1904 there was a decrease of 8.954, or 29.51 per cent, in the number of persons employed and of 21,598,071 pounds, or 26.62 per cent, in the quantity of the products, with an increase of \$862,108, or 25.83 per cent, in their value. There was also an increase of \$1,582,969, or 26.45 per cent, in the investment.

The number of persons engaged in the fisheries of Virginia was 19,378, the investment was \$10,709,499, and the products amounted to 471,219,089 pounds, having a value to the fishermen of \$8,541,724. The principal species were oysters, 3,963,569 bushels, or 27,744,983 pounds, exclusive of shells, valued at \$2,349,161; menhaden, 366,379,425 pounds, valued at \$2,158,518; shad, 7,293,805 pounds, valued at \$1,145,106; squeteague or "sea trout," 12,908,502 pounds, valued at \$654,521; crabs, 40,911,237 in number, or 13,637,079 pounds, valued at \$565,564; croaker, 16,372,134 pounds, valued at \$513,975; alewives, fresh and salted, 16,665,100 pounds, valued at \$259,258; clams, 449,440 pounds, exclusive of shells, valued at \$229,645; and butterfish, 3,018,842 pounds, valued at \$136,894. Compared with 1904, there was a decrease of 9,490, or 32.87 per cent, in the number of persons employed, but an increase of \$6,094,565, or 132.06 per cent, in the investment, of 115,903,291 pounds, or 32.61 per cent, in the quantity, and of \$2,957,370, or 52.95 per cent, in the value of the products.

#### SHAD AND ALEWIFE FISHERIES OF THE POTOMAC RIVER.

The shad and alewife fisheries of the Potomac River in 1921 were engaged in by 983 fishermen. The number of boats used was 623, valued at \$77,150. The fishing apparatus included 266 pound nets, valued at \$87,295; 296 gill nets, valued at \$37,565; and 6 seines, valued at \$1,540. The shore and accessory property was valued at \$7,735, and the total investment amounted to \$214,885.

The number of shad taken was 405,872, or 1,160,438 pounds, valued at \$207,370, of which 49,681, or 138,207 pounds, valued at \$25,191, are credited to Maryland and 356,191 shad, or 1,022,231 pounds, valued at \$182,179, to Virginia. Compared with 1920 there was a falling off in the catch of 123,486 shad, or 819,342 pounds, in quantity and of \$127,094 in value.

The catch of alewives, or river herring, was 10,303,510 fish, or 4,121,404 pounds, valued at \$44,041, of which 1,395,000 fish, or 558,000 pounds, valued at \$9,010, are credited to Maryland and 8,908,510 fish, or 3,563,404 pounds, valued at \$35,031, to Virginia.



## FLORIDA SPONGE FISHERY.

The quantity of sponges sold at the Sponge Exchange, Tarpon Springs, Fla., in 1921, was 386,390 pounds, valued at \$540,093. This total included large wool sponges, 173,723 pounds, valued at \$463,170; small wool, 63,786 pounds, valued at \$28,705; yellow, 70,218 pounds, valued at \$30,428; grass, 65,745 pounds, valued at \$12,823; and wire, 12,918 pounds, valued at \$5,167. The prices of small wool sponges were so low the latter part of 1920 that several thousand bunches were held over for sale in 1921. For this reason the quantity of small wool sponges for 1921 was larger than for the previous year. It is estimated that \$40,000 worth of sponges were sold at Tarpon Springs outside of the exchange. In addition an unknown but comparatively small quantity was sold at Key West.

## INQUIRY RESPECTING FOOD FISHES AND FISHING GROUNDS.

## INTRODUCTION.

It is an original and fundamental function of the bureau to inquire into the causes of the decrease of food fish and other useful resources of the waters, in order to seek means of checking decreases where they appear and of promoting increases wherever possible. Decreases of aquatic resources have occurred and are likely to continue with the increased demand upon the fish-food supply and with a growing population that steadily augments the number of possible fishermen and sportsmen.

There is indeed a conspicuous contrast between the histories of production of land and water products, respectively. While over a span of years we see with gratification a steady and noteworthy development in the yields of principal products of the land, we observe at the same time and, unfortunately, with generally small concern, an entirely different trend with regard to the crops that are derived from our waters. While we grow more wheat and corn, more cattle and poultry, we have less halibut and whitefish and fewer crabs and lobsters. New regions have been opened to production of potatoes and fruits, while considerable areas of water bottom, once productive of oysters, have become barren and sturgeon and other useful fishes disappear. Many of our fisheries bid fair to become merely historical records.

It is notable, too, that when a serious diminution in land crops threatens there is almost invariably a prompt and compelling demand for the application of methods of scientific research to the study of causes and remedies. Appropriations and personnel are made available so that serious losses may not continue indefinitely for lack of the services of skilled investigators or for want of proper equipment for attack upon the problems involved. On the other hand, the disappearance of useful aquatic resources has rarely awakened an effective public interest, and only a small and frequently changing personnel with very limited equipment is permitted to confront the complicated problems that concern a hundred different resources of seas, lakes, and rivers. While a diminution in the yield of corn becomes a

cause for action, a decline in production of shad remains a topic for conversation.

This is not to say that the exhaustion of fishery resources is inevitable or that the decline of fisheries has not in some instances been arrested or retarded. In many cases, though not in all, effective results have been gained by the application of measures of production and propagation as far as has been permitted by the knowledge available and by the public will. Investigations pursued in the past have yielded a certain fund of knowledge regarding propagation, habits, and conditions of life of fishes, and upon such knowledge is based both the fish-culture work that is so extensively pursued in the United States and the great body of sound protective measures whenever in effect. Were the fund of knowledge greater, artificial propagation would be more successful and economical and would no doubt be effectively extended to other species, while protective legislation would be more wisely framed and more successful in the accomplishment of its purpose.

Never, perhaps, has there been greater demand for the application of knowledge regarding fishes to practical ends for the public good, while yet there is no proportionate demand for the discovery of the knowledge that can be given application.

During the past year the bureau has endeavored to apply its limited resources to the problems of the fishes in the most effective manner, having regard, inevitably, to the qualifications and experience of its available personnel and to the limited funds and equipment. The story of the progress and accomplishments in biological investigations is told in the following pages.

#### STUDIES OF FISHES.

Extensive studies were conducted of the runs of salmon in Alaska to determine the facts necessary for effective regulation of the fisheries, to the end that they may be maintained and improved. An important feature of this work is the determination of the proportion of the runs that must be permitted to escape to the spawning grounds in order that the natural increase may compensate for the fish captured before spawning. The bureau has accumulated some information on this subject in connection with its fish-cultural operations at Baker Lake and Quinault Lake, Wash., but conditions vary with the locality, and before the results can be generally applicable in a practical way it will be necessary to make careful studies in a number of streams presenting diverse physical conditions. During the year a rack was established in Karluk River, on Kodiak Island, and careful check was kept of the number of salmon passing to the spawning grounds after escaping the fishery conducted entirely below the point of observation. Studies of the life history and migrations of the salmon of the Pacific Coast States have been continued as in previous years.

Investigations of the fishes of the whitefish family have been continued and during the fiscal year were extended to Lake Superior. Some of these fishes are of great present commercial importance and others have potential value but are not now exploited because of their place of occurrence, the ignorance of the fishermen concerning their habits and habitats, or the inhibitions imposed by laws and regulations made for the protection of some other species.



These studies have included the systematic relationships of the several species, their distribution, life histories, and habits, rate of growth, ages at maturity, and maximum size, etc. Certain of these, particularly the age at maturity, appear to be subject to local variation. It is expected that a report embracing facts of value to fish culture and serving as a basis for rational conservation measures will be practically completed during the next year.

Owing to the great importance of the fisheries of Chesapeake Bay, the decline in numbers of certain important food fishes, the ease with which some of them can be intercepted and captured, and the fact that the waters of the bay are under the jurisdiction of two States that can not always reconcile their conflicting interests, it appeared important to undertake an investigation of the fishes in order to furnish information to those responsible for their conservation. The field work was begun near the end of the last fiscal year and has now been brought practically to a close. The study of collections and valuable notes and records accumulated has made some progress. The fishermen have evinced appreciation of the practical value of this work and have cooperated freely in supplying specimens and information and in giving access to fishing records.

Primarily as an incident to other duties, certain of the bureau's workers have been able to make material additions to knowledge of fresh-water fishes of economic value. In particular the information obtained concerning the natural history of the rock sturgeon is of importance in the formulation of measures to protect that valuable fish, which is yearly becoming less abundant.

Largely by volunteer cooperation with the faculty and graduate students of the University of Wisconsin, useful studies have been made of the food and feeding habits of certain fresh-water fishes.

#### INVESTIGATIONS RELATING TO FISH CULTURE.

The experiments in pond culture of the buffalofish that have been conducted at Fairport (Iowa) station for several years have demonstrated that while not entirely necessary it is definitely advantageous to cause a rise in the water level of the pond at the spawning time, thus simulating by the production of an "artificial flood" the conditions that prevail at the annual rise of the streams of the Mississippi Valley. In a pond used in the experiments the progeny of eight fish at the end of the season numbered 98,000 fingerlings from 2 to 5 inches long, a product equivalent to a yield of about 1 ton of fish to the acre. A paper on the pond culture of buffalofish, one of the most important food fishes of the Mississippi, has been prepared for the instruction of owners of ponds desiring to raise fish for home or local consumption.

The beneficent and maleficent relations of aquatic insects to pond culture was continued as a useful subject of investigation during the year. The life histories of nine species of beetles and bugs were worked out, and methods of control of the undesirable species have been indicated.

At the request of the Iowa State Game and Fish Commission an examination was made of Clear Lake, Iowa, which resulted in recommendations toward the development of a commercial fishery for "rough" fish, the propagation of game fishes, and the general management of the water area in the interest of increased fish production.

Suggestion having been made that the method of stripping salmon and trout now practiced at the bureau's stations was faulty, a scientific assistant was detailed to cooperate with the fish-culturists at Erwin (Tenn.) station in experiments to determine whether the method suggested, in which the fish is held in the natural position, belly down, and the pressure applied only back of the ventral fin, was superior to that now employed. It was determined that the established method, when carefully and skillfully applied, is better than that proposed, principally for the reason that less time is required in the operation and the fish subjected to less handling.

The position of fish-pathologist was filled in February, after a long vacancy, and the new incumbent has been active in investigating the causes of disease and mortality in fishes both in the bureau's hatcheries and in wild waters. Immediate and particular attention was devoted to the high mortality among rainbow-trout fingerlings shipped from White Sulphur Springs (W. Va.) station, and it was practically determined to be due to a protozoan parasite occurring in vast numbers in the intestine. This organism appears to have an unusual life history, and it is still under investigation in the hope that a weak link in its life chain may be found to furnish a point of application for remedial measures.

Various assistants and collaborators of the bureau have examined into the occurrence and causes of the death of fishes in lakes and streams, and progress has been made in the study of conditions affecting the prevalence of parasitism in fishes in natural waters and the possible relation of parasites to retardation of growth in their fish hosts. For a number of years there has been a number of deaths among diamond-back terrapin hatched at Beaufort (N. C.) station and held under the unnatural condition of nonhibernation and winter feeding. This has now been determined to be due to a characteristic bacterial organism, and further studies may develop methods of combating the disease.

#### STUDIES OF RIVER, LAKE, AND SEA.

In its investigations of mortality and diseases of fishes, oysters, crabs, etc., and of the causes of sudden or gradual changes in their abundance the bureau has often been baffled by the lack of accurate knowledge of normal physical, chemical, and biological conditions in the waters affected. With the purpose to remedy this deficiency an investigation of Chesapeake Bay was undertaken during the fiscal year 1921. The field work was practically completed in that year, but two supplementary cruises were made in 1922. During the year covered by this report attention has been devoted to the compilation and digestion of the physical and chemical data relating to the waters of the bay and to sorting the biological material preparatory to assigning it to the specialists for study and identification.

Research of the same character was begun during the year in Long Island Sound and contiguous waters, where the investigations of the bureau and of the States concerned into the difficult problems presented by the failure of the oyster set have been hampered by lack of information concerning the extent and dissemination of pollutions inimical to oyster culture and fishes and the character of the currents and the distribution of temperatures and salinity of the water.



In view of the recent and prospective development of hydroelectric projects much interest attaches to the effects of dams and artificially impounded waters on the fisheries of interior waters. When the great dam across the Mississippi River was constructed a number of years ago many persons expressed the opinion that, particularly in the absence of a fishway, the value of the fisheries of the upper river would be seriously impaired. For this reason the bureau has kept Lake Keokuk, the large body of water thus created, under periodical observation, and during the months of July, August, and September, 1921, it made an examination to determine the quantity of fish feed developed in this lake as compared with the natural river and Lake Pepin, a natural lake of about the same size, lying in the course of the Mississippi River in Minnesota and Wisconsin. It was found that the content of floating organisms (plankton) per unit of water volume was considerably greater in Lake Keokuk than in the adjacent part of the river but much less than in Lake Pepin. The yield of the fisheries in the part of the stream covered by Lake Keokuk has increased since the erection of the dam, probably as a result of the increased food supply.

At very small expense the bureau has been able to continue co-operation with the Wisconsin Geological and Natural History Survey in very important and fundamental investigations of the fish food resources of small lakes. The results indicate a surprisingly high production of plants and animals per unit of water surface and confirm the opinion long held of the potential importance of lakes and ponds as producers of food.

#### FRESH-WATER MUSSELS.

The propagation of fresh-water mussels, which provide the raw material for the valuable pearl-button industry of the Mississippi Valley, years ago attained large proportions and in the opinion of the industry has achieved results. The bureau has not been satisfied, however, to rest on present accomplishment but is constantly striving to improve the economy and effectiveness of the work and to extend it to species that have not satisfactorily responded to the methods now employed. For these reasons a material part of the activities of Fairport (Iowa) laboratory have been devoted to research and experiment on these river mollusks. If a satisfactory method could be developed for rearing the juvenile mussels to a stage at which they could be planted directly on suitable bottom a definite advance in mussel propagation in public waters would be achieved, and it would make possible a system of private mussel culture comparable with that extensively practiced with the oyster in coastal waters.

Some of the experiments in this field at Fairport have been highly successful, while the results of others conducted under seemingly favorable conditions have been insignificant. There are unknown or unrecognized conditions involved, and in addition to the direct experimentation the attachés of the station have undertaken the comprehensive study of all of the biological and physical factors that may have bearing on the subject. The work as a whole has given such encouragement of ultimate success as to make its continuance imperative.

In the method of mussel culture now practiced it is necessary to handle large numbers of live fish, and the minor injuries that they

receive permit infections by bacteria and "fungus," which often result in death. It has been discovered that this difficulty may be overcome by immersing the fish in a solution of copper sulphate after the encystment of the glochidia. The latter are not injured by the treatment.

The recommendations of the bureau for extending protection to mussels having been given effect by a number of the States, some of the closed areas have been placed under systematic observation to determine the results. The condition of the beds has been determined with respect to the abundance and ages of shells of different species for comparison with similar data to be collected five years hence.

An examination of the records of the catch of mussels on White River, Ark., over a period of years has confirmed the observations of mussel buyers on the stream that the artificial propagation of the yellow sand-shell on the river a number of years ago has resulted in a material increase in the production of that valuable shell.

#### OYSTER INVESTIGATIONS.

The grave difficulties with which the oyster industry has had to contend in recent years, particularly in Long Island Sound and on the south wash of Long Island, have continued to receive the bureau's attention.

In Long Island Sound the set of young oysters has never been regular within historic times, but until recently it occurred with sufficient frequency to permit the upbuilding of the most extensive oyster-cultural operations in the country. This region is on the minimal temperature verge of the oyster's habitat, and the investigations made by the bureau have now shown that a water temperature suitable for spawning and the development of the oyster larvæ is attained for but a short time each year. In the summer of 1921 this temperature was reached exceptionally early, but this condition, which ordinarily would have been favorable, was interfered with by subsequent cold, rainy weather, during which the larvæ disappeared.

The inshore, shoaler, warmer waters, which formerly supported the natural beds furnishing the spat that seeded the planted beds in the colder deep waters of the sound, have been largely depopulated by pollution with trade wastes. The solution of the problem appears to lie in planting and maintaining spawning beds in shore waters not yet seriously contaminated and in reducing the pollution now existing in other areas. The work in Great South Bay revealed an early occurrence of spawning and a great abundance of oyster larvæ widely distributed, and, later, a correlated abundance and distribution of young oysters on the planted shores. Still later practically all of this set died, and the investigator is of the opinion, although it was not possible to demonstrate it as a fact, that this mortality was due either to the generation of toxic gases or the exhaustion of oxygen by the organic matter in the bottom mud. It was observed that the oysters that had set on materials experimentally raised above the bottom survived, and the investigator has suggested to the planters that a similar method be tried commercially during the season of 1922.



During the year a plague of mussels interfered seriously with the oyster industry of Chesapeake Bay. An investigation in December and January indicated that the distribution of the mussels was limited within a narrow range of salinity of the water and was probably due to the paucity of rainfall during the preceding summer. This is one of the oysterman's troubles that is beyond control but that, while costly during its prevalence, will correct itself.

#### POLLUTION OF WATERS.

Pollution of interior streams and waterways by industrial wastes and municipal sewage has been the subject of complaint and protest for many years. Industry, itself, frequently has been a victim of its own acts through inability to use the polluted water with safety in boilers or for the many other industrial purposes that require pure water. The public health has been menaced, public works have been damaged, agriculture has suffered, and in some parts of the country the streams have been swept bare of living things, including fishes and other animals of economic importance. Recently the vast development of petroleum production and transportation, the use of its derivatives for manifold purposes ashore, and particularly as fuel on ships, has introduced a new element of serious pollution in the great harbors and in places on the open coast.

The pollutions are almost as varied as industry and in many cases are not only complex in themselves but are further complicated by their reactions on one another and on the natural constituents of the waters themselves. The waters can not be restored to their pristine purity, nor to any state approaching it, by mere legislative fiat, and the sooner that fact is appreciated and constructive measures are taken the better for the public welfare.

The pecuniary losses now suffered as the result of water pollutions are enormous, and the preventable damage to the life and beauty of our streams, lakes, and seacoast is beyond estimate in terms of mere money. If existing abuses are to be corrected and new ones prevented without inflicting widespread economic injury, something more constructive than drastic laws must come into being. There must be corrective legislation, but it should be based on something more substantial than a perfectly justifiable desire for improvement. Complete utilization of raw materials is an ideal not attainable. Industry must be accompanied by "waste," and the wastes must be disposed of in some manner. The problem is to devise ways of disposing of them so as to minimize their harmfulness while still permitting industrial development. This is the problem of the biologist, the chemist, and the engineer working in cooperation.

The effects of these pollutions on the fisheries are the only phases of the subject that officially concern the bureau, and it has continued to endeavor, so far as its means would permit, to contribute to the solution of the problems involved; but it is futile to expect that much can be done unless money and, particularly, trained and capable men are provided for the purpose of determining facts and their practical and scientific implications.

#### BIOLOGICAL LABORATORIES.

The laboratory at Woods Hole was not operated during the summer of 1921 because of the limitation of funds, but its facilities were

extended, at no expense to the bureau, to a number of investigators connected with the Marine Biological Laboratory. In the summer of 1922 the laboratory was reopened with a very small staff of the bureau's workers and a considerable number of volunteers investigating marine biological problems of their own selection.

The station at Beaufort continued without a scientific director on account of the inadequacy of the salary to attract a man with sufficient training to discharge the duties of the position. Experiments in terrapin culture were continued, and the facilities of the station were utilized by the Navy Department for investigations relating to the prevention of fouling of ships' bottoms. Several independent investigators were also accommodated.

With the exception of two months the laboratory at Key West has been without a technical staff on account of the low salaries.

The principal work of the Fairport (Iowa) laboratory has been briefly described elsewhere in this report.

#### PROPAGATION AND DISTRIBUTION OF FOOD FISHES.

##### REVIEW.

During the fiscal year 1922 the fish-cultural work of the bureau was conducted along established lines on the usual extensive scale and with satisfactory results despite many difficulties. On the Pacific coast low water, followed later by freshets, affected the collection of salmon eggs. Through the Great Lakes region warm weather in the early part of the season retarded the run of whitefish and lake trout and lowered the quality of their eggs, but conditions improved later. Unseasonable weather occurred during the period when the pond-fishes were spawning and resulted in chilling the eggs of the basses, crappie, sunfish, and other spring-spawning species.

A comparison of egg collections and of the output of the hatcheries with the previous year shows a considerable divergence in the numbers of the various species handled. The present year exhibits an increase in the output of such species as the buffalofish, glut herring, shad, whitefish, Pacific coast salmon, trouts, yellow perch, cod, striped bass, and winter flounder, while decreases are evident in the output of carp, smelt, pike perch, haddock, and pollock. These annual variations may be accounted for primarily by climatic conditions, which favorably or otherwise affect the spawning of any species. Another factor that contributed largely to the decrease in output was the reduction of funds for fish-cultural operations. The force for the collection of eggs must be assembled and placed in the field in advance of the expected run of fish, that they may be in readiness to secure the eggs as soon as they are available. In many very promising fields it was not possible to conduct operations until the close of the season nor to hold the field force for delayed runs of fish on account of limited funds.

The most important operations of the division of fish culture are those addressed to the maintenance of certain of the great commercial fisheries, which because of their magnitude must be considered factors of importance in the maintenance of the fish supply of the country. A reduction in the general fund set aside for the propagation and distribution of food fishes must necessarily affect this class of work.



Further points of interest to be noted in comparing the present season's output with that of 1921 is an increase of approximately 33 per cent in the production of fingerling fish, a decrease of 6 per cent in operating costs, and a decrease of but 1 per cent in the aggregate output. The output for 1922 was 4,925,081,320, as compared with 4,962,489,405 for 1921, while the cost per million fish produced for distribution for the present year was \$125.57, as against \$128.06 for 1921.

During the fiscal year 1922 fish-cultural work was conducted in 33 States and in the Territory of Alaska through the operation of 38 main stations and 35 auxiliaries. At these stations over 40 species of valuable food fishes were propagated. The output may be classified on the following geographic basis, which agrees with the general character of operations at the hatcheries: Anadromous species of the Atlantic coast, anadromous species of the Pacific coast, marine species of the Atlantic coast, fishes of the Great Lakes, and fishes of the interior waters.

*Summary, by species, of the output of fish and fish eggs during the fiscal year ended June 30, 1922.*

Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Total.
Catfish.....			52,137,880	52,137,880
Buffalofish.....	86,906,000	51,000,000	3,341,480	141,247,480
Carp.....		82,050,000	22,006,805	104,056,805
Shad.....		63,461,200		63,461,200
Glut herring.....		82,600,000		82,600,000
Whitefish.....	156,242,000	306,350,000		462,592,000
Cisco.....	220,690,000	47,400,000		268,090,000
Chinook salmon.....	1,400,000	1,311,550	57,769,870	60,481,420
Chum salmon.....		1,540,000	14,027,610	15,567,610
Humpback salmon.....		369,860	1,119,400	1,489,260
Silver salmon.....		600,000	11,074,940	11,674,940
Steelhead salmon.....	450,000	20,000	2,028,220	2,498,220
Sockeye salmon.....	150,000	32,600,000	59,522,365	92,272,365
Atlantic salmon.....		1,334,000	180	1,334,180
Landlocked salmon.....	115,000	187,230	95,780	398,010
Rainbow trout.....	2,377,840	410,700	4,439,685	7,228,225
Blackspotted trout.....	1,097,500	493,400	931,000	2,521,900
Loch Leven trout.....			56,000	56,000
Lake trout.....	2,796,000	29,359,365	213,090	32,368,455
Brook trout.....	255,000	3,019,050	6,717,805	9,991,855
Grayling.....		250,000		250,000
Smelt.....		300,000		300,000
Pike and pickerel.....			679,795	679,795
Crappie.....			36,468,545	36,468,545
Largemouth black bass.....		281,700	1,652,710	1,934,410
Smallmouth black bass.....		568,250	76,990	645,240
Rock bass.....		800	52,095	52,895
Warmouth bass.....			2,515	2,515
Sunfish.....			52,697,985	52,697,985
Pike perch.....	79,650,000	55,897,500	34,390	135,581,890
Yellow perch.....	34,400,000	207,527,000	1,604,350	243,531,350
White bass.....			36,510	36,510
Striped bass.....		25,530,000		25,530,000
Fresh-water drum.....			242,025	242,025
Cod.....	84,164,000	232,131,000		316,295,000
Haddock.....		290,820,000		290,820,000
Pollock.....		327,380,000		327,380,000
Winter flounder.....	193,178,000	1,867,378,000		2,060,556,000
Pole flounder.....	5,090,000			5,090,000
Mackerel.....		1,980,000		1,980,000
Scup.....		2,505,000		2,505,000
Sea bass.....		32,000		32,000
Miscellaneous river fishes.....			10,402,355	10,402,355
Total.....	868,961,340	3,716,687,605	339,432,375	4,925,081,320



## DISTRIBUTION OF OUTPUT OF HATCHERIES.

The output of the hatcheries is given a wide distribution, fish or eggs being delivered to interested persons and State commissions in practically all parts of the country, including Alaska. To accomplish this, five specially equipped railroad cars, having living quarters for a crew of five men and compartments in which live fish may be carried several days without loss, were in active service through the greater part of the year. These cars traveled 77,128 miles, and detached messengers in charge of consignments of fish traveled 306,215 miles, in the efforts of the bureau to supply over 10,000 applications for fish.

The cars were employed principally in distributing the fishes of interior waters, which were supplied on requests of individuals, fisheries associations, and State fisheries officials, and to waters of national parks, Forest Reserve, and Reclamation Service. The commercial species of the Atlantic and Pacific coasts and of the Great Lakes are distributed for the most part by boats operated by station crews. These fish are liberated on the natural spawning grounds, or, in some instances, in barren waters where conditions favor their development. Nonindigenous fishes are introduced with great caution and only after a study of environment and careful consideration as to the future effect that the introduced species may have on the indigenous fishes. This is especially true with reference to the introduction of the spiny-rayed fishes into trout or salmon waters. Trout eggs have been successfully planted in some of the more remote waters of mountainous regions by depositing them 10 or 12 days previous to the hatching period; approximately 10,000 to 15,000 eggs are allowed to a mile of stream.

## RELATIONS WITH STATES IN FISH CULTURE.

Closer cooperation has been brought about between the bureau and many States engaged in fish culture, since it has been pointed out to them that there is more or less duplication of effort in stocking waters. In many instances the States and the bureau combined money and forces, resulting in a saving of funds and more efficient work. States having inadequate or no hatching facilities have been permitted to utilize the bureau's hatcheries for the purpose of incubating their eggs, when the same could be done without interference with the bureau's operations. Increased travel in the United States, especially by automobile, has caused a serious depletion of fish life in many sections, and the States realize that their institutions are not capable of coping with the situation alone. By a combination of effort eggs and fish are moved from one section of the country where they may be surplus to another where they may be used in stocking depleted waters. Fish are removed from overcrowded waters where they serve as forage for larger fishes and are placed in more suitable environments where they will eventually be of benefit to the public. The State authorities lend their assistance and cooperation in making this interchange possible and profitable.

During the year the bureau found it necessary to call the attention of State officials to the great and growing need for more adequate laws for the protection of food and game fishes. This need

applies to the Southern States more than to any other section, as waters that were once teeming with various species of fish are now becoming depleted, owing largely to the increase of tourist fishermen. The waters of the Southern States are naturally very productive, more so, possibly, than those of any other part of the United States, and owing to the abundance of natural food developed in them bass and other species grow to large size. In some sections the fish receive no protection whatever during the spawning season, when fishing should be absolutely prohibited. Many States have shown a deep interest in this matter, and in response to the bureau's recommendations have expressed the intention of bringing about the needed reforms in fishery legislation. The most notable example is Texas, which has recently passed special legislation covering the protection of bass and most of its important food fishes.

Mutually profitable cooperative relations have continued between the bureau and the Canadian fisheries authorities. Exchanges of Atlantic salmon eggs for eggs of the rainbow, brook, and blackspotted trouts have been made, and the collections of whitefish and cisco eggs in the Great Lakes regions have been largely increased by the fact that the Canadian authorities allowed the bureau's men access to waters in Canadian territory. The result of this cooperation has been a greater output of these species by both Governments.

During the fiscal year 1922 the fisheries authorities of 26 States were supplied with fish or fish eggs, as shown in the following table:

*Allotments of fish and fish eggs to State fish commissions, fiscal year 1922.*

State and species.	Eggs.	Fingerlings.	State and species.	Eggs.	Fingerlings.
Idaho: Whitefish.....	1, 000, 000	.....	Missouri:		
Illinois:			Rainbow trout.....	113, 011	36, 280
Black bass.....		227	Yellow perch.....	4, 000, 000	.....
Carp.....		100	Montana:		
Catfish.....		15, 165	Blackspotted trout.....	587, 500	.....
Crappie.....		4, 800	Chinook salmon.....	100, 000	.....
Drum.....		10	Lake trout.....	100, 000	.....
Pike.....		50	Rainbow trout.....	215, 000	.....
Rock bass.....		40	Steelhead salmon.....	72, 000	.....
Sunfish.....		30, 800	Whitefish.....	5, 000, 000	.....
Yellow perch.....		25	New Hampshire: Lake		
Indiana: Pike perch.....	13, 800, 000	.....	trout.....		14, 000
Iowa:			New Jersey: Lake trout.....	25, 000	.....
Brook trout.....		41, 500	New Mexico:		
Lake trout.....	50, 000	.....	Brook trout.....		36, 000
Pike perch.....	5, 100, 000	.....	Rainbow trout.....	75, 000	.....
Rainbow trout.....	206, 000	1, 500	New York:		
Kansas: Yellow perch.....	5, 000, 000	.....	Cisco.....	16, 050, 000	.....
Maine: Lake trout.....	50, 000	.....	Lake trout.....	1, 000, 000	.....
Maryland:			Steelhead salmon.....	50, 000	.....
Cisco.....	1, 000, 000	.....	Whitefish.....	15, 000, 000	.....
Chinook salmon.....		5, 000	North Dakota:		
Rainbow trout.....	135, 000	.....	Black bass.....		930
Massachusetts:			Catfish.....		5, 600
Buffalo fish.....		250	Crappie.....		280
Catfish.....		4, 000	Sunfish.....		4, 330
Michigan:			Yellow perch.....		700
Cisco.....	32, 500, 000	.....	Oklahoma: Rainbow		
Lake trout.....		600, 000	trout.....		113, 500
Rainbow trout.....	50, 000	.....	Oregon:		
Pike perch.....	56, 500, 000	.....	Chinook salmon.....	1, 300, 000	.....
Albino brook trout.....		10, 000	Grayling.....		25, 000
Minnesota:			Pennsylvania:		
Black bass.....		6, 395	Catfish.....		200
Crappie.....		3, 150	Cisco.....	114, 300, 000	.....
Lake trout.....	1, 200, 000	.....	Lake trout.....	50, 000	.....
Steelhead salmon.....	50, 000	.....	Pike perch.....	4, 200, 000	.....
Sunfish.....		39, 050	Steelhead salmon.....	50, 000	.....
Yellow perch.....		120	Whitefish.....	32, 340, 000	.....

*Allotments of fish and fish eggs to State fish commissions, etc.—Continued.*

State and species.	Eggs.	Fingerlings.	State and species.	Eggs.	Fingerlings.
Tennessee: Rainbow trout.....	50,000	16,000	Wisconsin—Contd.		
Utah:			Crappie.....		660
Brook trout.....	250,000		Sunfish.....		8,400
Lake trout.....	100,000		Yellow perch.....		2,975
Vermont:			Whitefish.....	21,000,000	
Lake trout.....	25,000	91,865	Wyoming:		
Rainbow trout.....		3,000	Blackspotted trout.....	250,000	
West Virginia: Rainbow trout.....		116,000	Brook trout.....		24,000
Wisconsin:			Lake trout.....	100,000	
Black bass.....		6,790	Rainbow trout.....	446,240	
Catfish.....		1,920	Total.....	333,519,740	1,270,662

*Shipments of fish eggs to insular possessions and foreign countries, fiscal year 1922.*

Country and species.	Number of eggs shipped.	Country and species.	Number of eggs shipped.
Canada:		Hawaii: Rainbow trout.....	51,000
Blackspotted trout.....	200,000	Switzerland:	
Landlocked salmon.....	100,000	Lake trout.....	50,000
Rainbow trout.....	450,000	Rainbow trout.....	50,000
Whitefish.....	61,192,000	Total.....	62,193,000
Czechoslovakia: Rainbow trout.....	100,000		

## COOPERATION WITH FISH-PROTECTIVE ASSOCIATIONS.

Realizing the necessity of greater protection for interior waters, the bureau has corresponded on the subject with fishing clubs and others who are interested in fishery matters. Many clubs have shown a willingness to protect the fish until they attain maturity and to curtail the number that may be taken. In some instances associations are holding fish furnished by the bureau in specially constructed ponds, where they will be fed and liberated later in the season. This cooperation has had the effect of reducing expenses and increasing the chance of survival of the fish furnished. The National Forest Service has taken the lead in this respect, having already established many ponds in the territory under its control. Many of the forest rangers have been instructed in the handling of fish and their proper distribution, and a record has been kept of all suitable streams and the number of fish liberated therein. The bureau has been pleased to cooperate with such organizations.

## PROPAGATION OF MIGRATORY FISHES OF ATLANTIC RIVERS.

The results of shad propagation on the Potomac River were good. Weather conditions throughout the season were generally favorable; there was a large catch of fish, and the take of eggs was over three times that of last year. The total output of the Edenton (N. C.) station was also materially increased. In this region the extensive operation of pound nets has had the effect of considerably curtailing the output of shad fry as compared with past years, most of the shad



under present conditions being taken in a green state, between salt water and the spawning grounds. A few fishermen were permitted to operate gill nets on the spawning grounds under licenses issued by the State, and the eggs taken from the fish caught are turned over to the hatchery. The most notable increase in the work at the Edenton (N. C.) station during the year was in the collection of glut-herring eggs. This species has commercial importance in Albemarle Sound, and it appears worthy of increased attention.

In the Roanoke River, in the vicinity of Weldon, N. C., striped bass appeared in large numbers, and over 48,000,000 eggs were obtained, fully twice the number in any preceding year. The greater part of this increase was due to the more effective work of the fishermen in supplying ripe eggs to the bureau's hatchery.

In advance of the shad-hatching season the Bryans Point (Md.) station was engaged in yellow-perch propagation. Eggs of this species are secured by collecting the adult fish and holding them in specially constructed live cars anchored in creeks near the hatchery until their eggs have been deposited, when they are liberated. The eggs are transferred to hatching jars, and the resulting fry are liberated in the streams from which the fish were derived. During the season a total of 21,620 adult yellow perch were collected, and from the females, which constituted about three-fourths of the lot, 199,660,000 eggs were taken, practically all of them being of first quality.

The propagation of Atlantic salmon at the Craig Brook (Me.) station was conducted as heretofore. At the beginning of the year there were on hand in the station inclosure awaiting the ripening of their eggs 199 adult wild salmon that had been purchased during the preceding two months from commercial fishermen, but the number was reduced at spawning time in October to 190, from which 572,000 eggs were taken. In addition 1,000,000 eyed eggs were received from the Canadian Government in March, in exchange for trout eggs, and from the combined stock 1,334,000 fry were liberated in the Penobscot River and tributaries in the month of May. At the close of the fiscal year 47 adult salmon were being held in the station pound. The number obtained was considerably smaller than usual, the decrease being due mainly to the low market price for Atlantic salmon, which did not justify the fishermen in expending much money in equipment.

During the fall of 1921, 445,000 eggs were secured from wild humpback salmon taken from Dennys River, at Dennysville, Me. These were incubated at the Craig Brook (Me.) station, producing approximately 370,000 fry for return to the Dennys River and tributaries. This run of fish resulted from the transfer of humpback salmon eggs from the Afognak (Alaska) station in November, 1917, being the second generation to ascend the river for reproduction. It therefore appears that the humpback salmon has become well established in the waters of the Maine coast.

#### PROPAGATION OF COMMERCIAL FISHES OF GREAT LAKES.

The bureau's operations in this region are confined to the propagation of such species as whitefish, cisco, lake trout, and pike perch. Operations with the first two species showed a satisfactory increase

in output as compared with previous years, this being made possible largely by favorable weather conditions in the latter part of the season, which permitted the commercial fishermen to operate their boats and handle their nets at the time the fish were on the spawning grounds. However, in the Saginaw Bay field, in Michigan, the collection of pike-perch eggs was brought to a sudden close a few days after the opening of the season by a severe storm that destroyed many of the nets belonging to the commercial fishermen. The need of a hatchery at some point on Saginaw Bay to take care of the immense numbers of pike-perch and yellow-perch eggs now being wasted in the fisheries in that field, is as great as formerly. It is estimated that approximately 1,000,000,000 eggs of each of these species are lost each year owing to the lack of proper hatching facilities for handling them. The eggs can not be successfully hatched at any of the interior stations because the water conditions there are not suitable, and the cost of transferring the eggs to distant hatcheries and returning the fry to the parent waters would be prohibitive, even if water conditions were favorable.

In compliance with demand, carp propagation in the western end of Lake Erie was prosecuted, as heretofore, from the Put in Bay (Ohio) station and about 82,000,000 fry were liberated in Portage River and adjacent waters. Through the courtesy of Port Clinton (Ohio) fishermen, the bureau installed and operated a temporary hatchery in one of the fish houses.

No attempt was made to collect whitefish eggs in the extreme western end of Lake Erie, as there were not sufficient fish on the grounds to warrant the fishermen in operating their nets. The falling off in the run of whitefish in this section of the lake in recent years is attributed to trade wastes from the Raisin, Maumee, and Detroit Rivers. The fishermen are convinced that the fish are seeking new spawning grounds, and most of the eggs obtained during the season were derived from fish taken in the vicinity of Middle Bass, North Bass, and Catawba Islands, and Port Clinton, Ohio. There was a good run of fish in these fields, and the Put in Bay hatchery was filled to capacity with eggs, the total collection amounting to 385,820,000.

#### PROPAGATION OF PACIFIC SALMONS.

There was an excellent run of sockeye salmon in the vicinity of the Afognak (Alaska) station. No trouble was experienced in securing all the eggs the hatchery could care for, and it was estimated that not over one-fourth of the available fish were used in the spawning operations. The take of eggs of this species for the season amounted to 53,835,000. On account of the warm weather during August and September the eggs advanced to the hatching stage fully three weeks earlier than under normal conditions, but no difficulty was encountered in holding the fry on the trays until the proper time for their distribution. A new method of transporting the fry, suggested by Alfred Nelson, was tested with good results. The fry were moved on trays stacked on a Yukon sled, with a tarpaulin covering, and it was found they could be transported in this way without bad effects when out of the water for as long as half an hour. A number of eggs that had been placed as an experiment in



gravel in an old hatching trough held in the creek were found to be a total loss, the eggs dying apparently on reaching the eyed stage.

The collection of sockeye-salmon eggs at the Yes Bay (Alaska) station extended from August 29 to September 27, 51,000,000 being taken. Protracted rains after the middle of September caused very high-water stages, which interfered to a considerable extent with seining operations. The first eggs taken showed the eye spots by September 27, and by November 1 all of them were eyed. The fry were held on trays in the hatching troughs until the sac was absorbed and they had commenced to come to the surface in search of food. A branch of the creek in front of the hatchery approximately 2,000 feet long was closed with a rack and stocked with fry, and in this protected area where the fry were fed, the edges of the grass and numerous little indentations along the bank were literally swarming with young fish. It is believed that this method of holding the fish more nearly approximates natural conditions and that the resulting fingerlings may be safely liberated in the body of the lake in the month of June, at which time but few of their natural enemies are present. The fry held in the hatchery were fed from June 1 to 29, when the food supply of salted salmon was exhausted and it became necessary to plant the entire stock. Two million fry were held in McDonald Slough, an arm of the lake located about 4 miles from salt water. They were put into the lake on May 11, and by July 25 those observed around the shores were 2 inches long. On September 10 the screen was removed and the fish were permitted to migrate into the main body of the lake. An experiment was tried of planting eggs within four or five days of hatching in the sand and gravel around the shores of several neighboring lakes. It is believed that such bodies of water as appear to have sufficient natural food may be stocked by this method and that the young will escape to the sea during high-water periods without injury. The usual run of humpback salmon entered the lake early in July, and approximately 246,000 eggs of that species were taken.

Operations were conducted at Baker Lake and at six of its auxiliaries in Washington. Five of these stations were open during the entire year, and all species of Pacific coast salmon and the steelhead were handled, the total egg collections of the group amounting to 47,693,000. Although there was a slight decrease in egg collections at some of the stations, the work as a whole exceeded that of the past year. At Baker Lake the work of constructing buildings to replace those destroyed by fire several years ago was completed, and a new trap was installed at the outlet of the lake. This trap is located some distance below its predecessor and apparently functions better. The new hatchery has a capacity for 30,000,000 eggs and 25,000,000 fry, when carried in the stacked tray system. The usual fish-cultural operations and repairs were conducted at all of the substations in Washington. Humpback salmon began ascending Duckabush River in the vicinity of the bureau's station on September 2, and the run lasted an entire month. It is believed that fully 75 per cent of this run escaped the traps and spawned naturally. Eggs to the number of 874,000 were collected, and the resulting fish were returned to the river in the advanced fry stage.

At Quinault Lake (Wash.) station, two concrete rearing ponds of the long narrow type with sloping sides were constructed. They



are 75 feet long, 6 feet wide, with an average depth of 30 inches, and have an estimated capacity of 50,000 sockeye fingerlings. Shortly after September 15, traps were placed in the rack at Big Creek, and the equipment was made ready for the spawning season, which opened October 1. The sockeye salmon counted through the trap at the end of June, 1922, numbered 199,489, in addition to 429 steelheads and 251 blackspotted trout. It is estimated that the run was equal to the big run of 1915. Many of the Indians secured excellent catches of salmon, some taking as many as 300 fish per day with dip nets, and a profit of from \$200 to \$300 per day for the gill-netters was not unusual. A price of 50 cents per fish, regardless of size, was paid by the packers throughout the season. Of the salmon counted at the weir 8.8 per cent had received gill-net markings at the mouth of the river.

Fish-cultural operations were conducted as usual in the California field, and at Baird and its two auxiliaries an average number of fry was held and fed to the fingerling stage. The total number of chinook-salmon eggs collected amounted to 6,353,000. All of these stations are in need of extensive rearing ponds and a more adequate water supply.

The usual egg collections were made at the stations in Oregon, although a rise in the Clackamas River ended the season suddenly at Clackamas station on October 28, when a portion of the rack was carried away, allowing large numbers of chinook and silver salmon to pass upstream. Both runs of chinook salmon were equal to expectations throughout the field except on the Rogue River and in Idaho, the take of eggs at these points being materially lessened by high water during the late spring when the snow was melting. At Clackamas and its auxiliaries 63,685,000 eggs were collected, of which 57,885,000 were chinook salmon. Salmon fry to the number of 51,446,000 were retained at the various points to be fed, but it was found later that this heavy stock was overtaxing the capacity of the hatcheries, and the surplus had to be released. It is very essential that increased holding space be provided in advance of another season's operations so that all salmon produced may be held and fed for liberation at a more advantageous period. The fish held appeared to thrive and showed no ill effects from a diet of middlings mixed with meat. It has been found that by feeding the fish slowly twice a day the results are better than if fed from four to six times daily. In liberating the fish from the sloughs and other inclosures experience has shown that it is preferable to release them in small lots.

#### PRODUCTION OF MARINE SPECIES.

Collections of eggs at the marine stations exceeded those of 1921 by approximately 300,000,000, but the output was materially less than in the preceding year, owing to the adverse conditions under which the eggs were obtained and their resultant inferior quality. On account of the shortage in funds spawn takers could not be placed on the vessels of the offshore fishermen to fertilize and plant the ripe spawn taken. The Boothbay Harbor (Me.) station confined its efforts to the propagation of the winter flounder, of which the output amounted to 922,-

777,000. Operations at the Woods Hole (Mass.) station were somewhat restricted on account of the few vessels operating on the fishing grounds as a result of the low market price for fish. Another factor that largely affects the success of the cod work at this point is that comparatively few of the vessels operating on the more important fishing grounds are constructed with wells for the transportation of live fish, and the supply of brood fish, therefore, is limited. During the season 4,023 brood cod were received, and from them 280,466,000 eggs were obtained. The propagation of winter flounders was unfavorably affected by weather conditions, the severe cold at times making it necessary to cut through several feet of ice in setting and attending the nets. At Waquoit but 71 brood females, yielding 819,927,000 eggs, were obtained. Work at Wickford, R. I., which is conducted later in the season, was almost a failure on account of unseasonably high-water temperatures. The steamer *Halcyon* was put into the Newport field to collect eggs from fish caught in deep waters, but owing to the great depth and consequent low-water temperatures the fish did not spawn freely until it was too late in the season to make successful shipments of eggs to the hatchery. From a consignment of 25,000 steelhead eggs transferred to the Woods Hole station from Birdsvlew, Wash., 20,000 fry were hatched and liberated in suitable waters on Cape Cod, most of them being placed in Johns Pond, at Mashpee, Mass.

Pollock work was taken up by the Gloucester (Mass.) station in November. Throughout the season there appeared to be an abundance of pollock on the inshore fishing grounds, but they were continually moving, causing great fluctuation in the daily catch and necessitating frequent shifts of nets. Owing to this difficulty the total egg collections for the season amounted to but 507,270,000, nearly 100,000,000 less than in 1921. The experiments with the pole flounder undertaken in the spring of 1921 were continued into July, and considerable information regarding the nature of the fish was secured. It appears that most of the fish spawn in August and September. The eggs are about one-twentieth of an inch in diameter, numbering approximately 470,000 to the liquid quart; they are buoyant, transparent, nonadhesive, and can not be successfully transported from the spawning grounds to the hatchery, and it would appear necessary, if the propagation of the species is to be continued, to secure eggs from the ripe fish caught by the commercial fishermen, fertilize them, and plant them on the spawning grounds. The collection of cod eggs for the Gloucester station extended practically through the entire winter and spring, though most of them were taken in March and April. During November and December numerous reports were received concerning the spawning of large numbers of cod off the coast of Plymouth, Mass., but on account of the bad weather it was not possible to make large collections there. In January in the Ipswich Bay field, the fishing boats were making large catches, when a heavy storm came up, scattering the fish and preventing fishing operations until late in March. With the approach of spring most of the gill-net fleet withdrew from this field, and from that time on the hatchery was dependent on the fleet of small boats operating there and in Massachusetts Bay. Heavy



spring rains sometimes cause the coastal waters to become so fresh that it is impossible to handle eggs of the marine species at the Gloucester hatchery, and under such conditions the spawn takers are instructed to carefully fertilize the eggs and plant them on the spawning grounds. The total cod-egg collections for the season amounted to 306,960,000, and owing to the water conditions 124,060,000 of this number were fertilized and planted immediately. The haddock eggs secured were for the most part obtained from fish caught on the inshore grounds, especially during March and April, when 90 per cent of the collection was made. Collections earlier in the season were curtailed by heavy storms.

#### CULTIVATION OF FISHES OF INTERIOR WATERS.

The output of brook, blackspotted, rainbow, and Loch Leven trouts for the fiscal year amounted in round numbers to 20,000,000, a decrease of approximately 4,000,000 as compared with the previous year. Brook-trout operations at the Leadville (Colo.) station were very successful, and the large stock of eggs obtained produced a good percentage of vigorous fry, which were planted in the waters of Colorado, Wyoming, and Montana. Five hundred thousand eggs of this species were diverted to the Glacier Park hatchery for incubation and stocking the waters of that reservation. In cooperation with the State authorities, the superintendent of the Springville (Utah) station made a successful brook-trout egg collection, and after retaining a sufficient number of eggs to meet local requirements, 1,959,000 were shipped to other stations of the bureau and State hatcheries.

In an effort to establish a source of supply for steelhead eggs in eastern waters, a consignment of eggs of that species was shipped from Birdsvie (Wash.) to Manchester (Iowa) station, the resulting fry to be reared for a brood stock.

The Meadow Creek station, in Madison Valley, Mont., was operated for rainbow-trout propagation as a subsidiary of the Bozeman (Mont.) station. A 6-inch wood pipe line was installed for the purpose of securing water from a spring and avoiding the use of creek water for incubation. The egg collection was somewhat smaller than that of the average season, due principally to adverse weather conditions during the spawning period. Through cooperation with the State of Montana, this station was kept open beyond the usual closing time, in order that the fry might be cared for until they had reached a suitable age for distribution in local waters. This avoided the heavy expense of shipping the eggs and returning the resulting fish from the main hatchery at Bozeman, and at the same time the loss was smaller and the fish better than would have otherwise been possible. By exchange, the bureau received a large number of blackspotted trout eggs from the Montana fisheries authorities. These eggs were considerably earlier than those produced in the Yellowstone park field and made possible a much more advanced distribution than usual from the Bozeman (Mont.) station.

Operations in Yellowstone Park were conducted by the superintendent of the Leadville (Colo.) station, who, with a force assembled at Gardiner, entered the park on May 25. The station was opened and racks installed in all suitable streams on the west side of the



lake. On account of the large amount of snow in the mountains to the east of the lake, the indications were that no fish would be found in the streams of that section until early July. Collections during June, 1922, were about equal to those during the entire season of 1921, and for the entire season of 1922 will probably be larger than the average. This increase is attributed to the heavier stocking of lakes and tributary streams in recent years, made possible by co-operation with the National Park Service. The superintendent of Yellowstone Park has rendered valuable assistance by furnishing pack trains for transporting the fish to the more inaccessible waters. Credit is also due the State of Wyoming for incubating eggs in the State hatchery at Cody and planting most of the resulting fry along the eastern boundary of the park. The Forest Service assisted in distributing fish in the waters along its southern and western boundaries.

The Saratoga (Wyo.) station constructed a field hatchery at Sage Creek, and succeeded in collecting 1,336,000 rainbow-trout eggs, most of which were utilized in stocking Wyoming waters, in co-operation with the State hatcheries. Glacier National Park hatchery was well stocked with eggs shipped from Bozeman (Mont.), Leadville (Colo.), and the Yellowstone Park (Mont.) stations, and a much larger number of fish were planted in the park than last year. In cooperation with the park authorities the waters have been catalogued, and an effort will be made to plant therein the most suitable species of fish, pursuing the work systematically from year to year. Assisted by Glacier Park and Montana fishery officials, the superintendent of the Bozeman (Mont.) station planted a consignment of brook-trout fingerlings in the headwaters of the Upper Kootenai River and Cameron Lake.

Spearfish (S. Dak.) station continued to make improvements to its pond system for the better handling of brook trout. This has been made possible through an arrangement with the city authorities for the use of the surplus water from the city reservoir. In the propagation of domesticated rainbow trout the results at this station continue to show improvement in both quality and numbers.

The most successful rainbow-trout work in the eastern section of the country was accomplished at the stations located at Neosho, Mo., White Sulphur Springs, W. Va., Erwin, Tenn., and Wytheville, Va. In recent years the output of rainbow trout from the Manchester (Iowa) station has been inferior, owing to the poor quality of its brood stock, but new blood has been introduced, and it is believed that this station will soon be producing eggs of its former high standard. Neosho (Mo.) station made arrangements with a company at Roaring River, Mo., for the collection of eggs from semiwild rainbow trout, and approximately 600,000 were secured from that source. At the Wytheville (Va.) station a filter and settling tank was installed for the purpose of eliminating roily water, heavy rains in that region causing the spring to become very turbid at times. This apparatus will remove approximately 90 per cent of the sediment from the water, making it practically clear at all times. Formerly it was almost impossible to rear young brook trout at this station, large numbers perishing every year during the roily-water period, but under the improved conditions it is believed no trouble will be experienced.

Anatomical studies of the rainbow trout by the division of scientific inquiry were continued throughout the year at the Erwin (Tenn.) station, and a number of facts pertaining to the reproductive organs of the female fish that were heretofore not understood have been brought out.

Climatic conditions during the spring of 1922 were not favorable to a large output of the pond fishes, except at San Marcos, Tex., and Louisville, Ky. At all the other stations of this class there was a marked decrease in the output, due to sudden changes in water temperature, which caused the bass to desert their nests.

Owing to lack of funds the bureau did not cooperate with the State of Minnesota in the collection of pike-perch eggs in the Rainy Lake region. Buffalofish propagation was conducted as usual in the State of Louisiana. Previous to the opening of the spawning season the hatchery on the Atchafalaya River was removed to Pelba, about 1 mile distant, because of the erosion of the river bank at the old site. Pelba is a more favorable location for the collection of buffalofish eggs, being nearer the center of the spawning grounds. Approximately 142,000,000 eggs were obtained, an increase of about 35 per cent over collections of the preceding year. The spawning season was delayed somewhat beyond the usual time by the backward spring, the first eggs being taken March 9, and on April 4 collections were discontinued on account of high water. Taking advantage of an opportunity, the bureau collected approximately 57,000,000 buffalofish eggs in connection with fishing operations on the upper Mississippi River at Bellevue, Iowa, and Lynxville, Wis. This is considered conservation work of the highest importance, since the eggs would be sent to the market and lost were it not for the intervention of the bureau.

#### RESCUE OPERATIONS IN MISSISSIPPI RIVER VALLEY.

The salvage of food fishes from the temporarily overflowed lands along the Mississippi River has continued to be a prominent duty of the fish-cultural service. All of the important old fields were occupied, but no new territory was covered for lack of funds. The work at Meredosia, Ill., was discontinued, because the former fields are now utilized for agriculture and by clubs interested in creating duck-shooting preserves. The owners of preserves refused to permit the bureau to operate seines in the pools on the ground that it would disturb the ducks and destroy their natural food. The equipment at this point was distributed among the upper river stations, and the buildings were sold to the highest bidder. The principal centers of rescue work were Homer, Minn., La Crosse, Wis., Marquette and Bellevue, Iowa.

Favorable water conditions permitted the rescue crews to start operations early in August, 1921. As the water receded additional crews were placed at points between Prescott, Minn., and Bellevue, Iowa, and the work was prosecuted until stopped by freezing weather in November. At La Crosse, Bellevue, and Marquette retaining stations are used for holding fishes needed for distribution to applicants. At other points it has been found more economical to operate from specially constructed house boats, as the rescued fish



are placed immediately in the open waters, none being retained for shipment. The total number of fish rescued in the Mississippi River during the season was about 178,475,000, at a cost of approximately 14 cents per thousand. Cooperation in the work was received from the States of Minnesota, Wisconsin, Iowa, and Illinois.

#### DISTRIBUTION OF MOSQUITO-EATING FISHES.

At a number of the bureau's southern stations it has been found that the mosquito-eating fish *Gambusia affinis* can be obtained in large numbers for the mere cost of collecting them from the pools, and in some instances they have been reared in the same ponds with the food fishes. In response to requests from the American National Red Cross and various State health authorities, shipments of *Gambusia* have been made by express, those receiving them paying the transportation charges. On account of the great service rendered the public, the bureau has felt itself justified in meeting reasonable demands for this fish.

#### ALASKA FISHERIES SERVICE.

##### EXTENT OF THE ALASKA FISHERIES.

The noteworthy feature of the salmon industry in 1921 was the great decrease in operations, only 83 salmon canneries being operated, 2 of which were new plants, as against 146 in the preceding year. The reduction of activities was most marked in the southeast and central districts. The catch of red salmon in the western district exceeded that of the two years immediately preceding, while the catch of salmon in the southeast district was the smallest in 17 years. The market for the cheaper grades of salmon was unsatisfactory, and this together with the anticipated light run of salmon in the central and southeast districts was no doubt largely responsible for the great reduction in activity.

The catch of salmon in the Alaska fisheries in 1921 was 37,905,591 fish, of which 26,103,291 were red or sockeye salmon, 7,156,818 humpback or pink salmon, 2,636,901 chum or keta salmon, 1,182,205 coho or silver salmon, and 826,376 king or spring salmon. Apportioned by geographical districts the catch in southeast Alaska was 11,852,511 fish, central Alaska, 7,929,346 fish, and western Alaska, 18,123,734 fish. Comparing these figures with the returns for 1920, it appears that there was a net decrease of about 42 per cent; coho, chum, and humpback salmon were taken in less numbers and king and red salmon in greater numbers.

The canneries, which utilized the greater part of the salmon catch, numbered 83, a decrease of 63 from 1920. The pack of canned fish was 2,596,826 cases, with a market value of \$19,632,744, a decrease of 1,832,637 cases and \$15,970,056 from the previous year. The pack of red salmon was larger and that of all other species was smaller than in 1920.

Other salmon products were 2,814,800 pounds of mild-cured fish, valued at \$608,218; 2,016,400 pounds of pickled fish, valued at \$179,414; 1,506,074 pounds of frozen fish, valued at \$127,442; 9,103,104 pounds of fresh fish, valued at \$418,265; 18,533 pounds of



dried and smoked fish, valued at \$2,479; 15,010 gallons of oil, valued at \$4,102; and 464,000 pounds of fertilizer, valued at \$13,920; giving \$20,986,584 as the total value of the products of the Alaska salmon industry in 1921.

The halibut fishery ranks next to the salmon fishery, and in 1921 yielded 9,575,287 pounds of fresh fish, valued at \$910,375; 7,599,097 pounds of frozen fish, valued at \$565,915; and 1,890 pounds of cheeks and pickled fish, valued at \$160.

Products of the herring fishery consisted of 14,523,441 pounds of Scotch-cured fish, valued at \$838,335; 406,250 pounds of Norwegian-cured fish, valued at \$20,433; 892,000 pounds of fertilizer, valued at \$26,760; 84,938 gallons of oil, valued at \$21,236; and 2,666,048 pounds of bait, valued at \$27,280.

The cod fishery yielded a catch valued at \$457,320. The products of the shrimp fishery were 344,986 pounds of fresh shrimp meat, valued at \$132,077. Minor items were: Whales, \$19,950; crabs, \$33,180; trout, \$18,925; sablefish, \$17,985; clams, \$9,940; red rockfish, \$362; and smelts, \$50.

The entire Alaska fishing industry, exclusive of fur sealing, gave employment to 15,070 persons, represented an investment of \$39,001,874, and yielded products valued at \$24,086,867.

A detailed account of the extent and condition of the Alaska fisheries in 1921 and of the activities of the bureau under the laws and regulations for the protection of the fisheries is embodied in the annual report of the Alaska service for that year.<sup>2</sup>

#### ENFORCEMENT OF FISHERY LAWS AND REGULATIONS.

Patrol of the fishing grounds in Alaska in 1921 was carried on with four bureau-owned and a number of chartered vessels. Three additional vessels were placed in commission by the bureau at the beginning of the fishing season of 1922, and a much larger number of small power boats are being made use of by stream guards and special employees. For the season of 1922 the persons engaged in connection with the enforcement of laws and regulations numbered 91, of whom 23 were regular and 68 were temporary employees. This is the largest force the bureau has ever put into the field.

A number of violations of the fishery laws occurred in 1921, being chiefly of four classes, fishing in streams or within the prohibited distances of the mouths of streams, fishing by aliens, wanton waste of salmon, and fishing during the weekly close period. Slightly over half of the cases were against natives, and over 80 per cent were brought in the southeast district. Convictions were obtained in 87½ per cent of the cases tried.

It is anticipated that the greatly increased force of stream guards employed in 1922, with more vessels for patrol, will have a deterrent effect on would-be violators. No doubt the knowledge that a bureau employee is stationed at the mouth of a stream will in most instances prevent any attempt at illegal fishing and thus with a minimum of annoyance and expense for prosecution the object of conservation of the fisheries will tend to be accomplished.

<sup>2</sup> Alaska Fishery and Fur-Seal Industries in 1921. By Ward T. Bower. (Bureau of Fisheries Document No. 933.)

Work of erecting markers near the mouths of salmon streams was carried on, those destroyed being replaced, additional streams marked, and old markers moved to conform to the closing order of December 30, 1921, which made the 500-yard prohibition applicable to all streams of southeast Alaska as well as of other districts.

A number of complaints have been made of the stealing of salmon from traps in southeast Alaska. Depredations of this character are regarded as outside the jurisdiction of the bureau, but assistance has been rendered to the officials of the Department of Justice, and transportation to its agents has been afforded on the bureau's vessels whenever possible in connection with efforts to suppress the practice. In the season of 1922 four vessels of the Navy Department were stationed in the southeast district to assist the Department of Justice, and Coast Guard cutters also took part in the work.

#### PRIVATE SALMON HATCHERIES.

The private salmon hatcheries in Alaska have been inspected as required by law. In 1922 two such hatcheries were operated. One of these, on Naha Stream, liberated 12,885,000 red-salmon fry in the fiscal year 1922, and the other, located on Hugh Smith Lake, liberated 9,647,000 red-salmon fry in the same period. The total rebate of taxes on canned salmon, at the rate of 40 cents per 1,000 fry released by these hatcheries, amounted to \$9,012.80.

#### NEW SALMON-FISHERY REGULATIONS.

In accordance with announcements duly issued, hearings were held at Juneau on October 19 and at Seattle on November 15 and 17 for the consideration of necessary changes in the regulations regarding salmon fishing in Alaska. The waters affected were those of southeast Alaska and of the region from Cape Newenham north and eastward to the Canadian boundary. Statements were also permitted to be made by interested parties in regard to the Copper River, Kuskokwim River, and Yukon River, in which commercial fishing is prohibited. As a result of these hearings the following order was issued on December 30, 1921:

Hearings having been given, after due notice in accordance with law, for the purpose of determining the advisability of limiting or prohibiting fishing in certain waters in Alaska, and to amend or modify certain existing regulations, and all persons having had full opportunity to be heard, it is hereby ordered, by virtue of the authority vested in me by section 6 of "An act for the protection and regulation of the fisheries of Alaska," approved June 26, 1906, that until further notice all fishing for salmon, or other fishing in the prosecution of which salmon are taken or injured, in all hereinafter described waters of Alaska be and is hereby made subject to the following limitations and prohibitions in addition to the general restrictions already applicable by virtue of existing laws and regulations:

1. Salmon fishing is prohibited in all streams, within 500 yards of their mouths, and in their tributaries and lakes, except as hereinafter permitted.

2. Fishing is permitted at Karluk beyond the zone 100 yards outside the mouth of Karluk River where it breaks through Karluk Spit into Shelikof Strait.

3. Fishing is permitted in Ugashik River below a line extending at right angles across the Ugashik 500 yards below the mouth of King Salmon River.



4. The driving of salmon downstream and the causing of salmon to go outside the protected area at the mouth of any salmon stream are expressly prohibited.

5. This order does not apply to persons taking salmon by any lawful means for local human food requirements, or for use as dog feed.

6. The waters of the Afognak Reservation are covered by presidential proclamation of December 24, 1892, and the regulations promulgated by authority thereof are not modified or affected by this order but remain in full force.

7. All previous orders of the Secretary of Commerce imposing limitations or prohibitions upon fishing in the waters covered by this order are hereby superseded.

8. This order becomes effective January 1, 1922.

Under date of February 17, 1922, an Executive order was issued creating a reservation to be called the Alaska Peninsula Fisheries Reservation, extending eastward from the Aleutian Islands Reservation to a line from Foggy Cape on the eastern end of Sutwik Island to Cape Menshikof on the northern shore of the Alaska Peninsula, and including the Shumagin Islands and the territorial waters adjacent to these lands and also the lands of the Aleutian Islands Reservation. The text of the order follows:

In addition to the islands of the Aleutian chain, Alaska, withdrawn and made a preserve and breeding ground for native birds, for the propagation of reindeer and fur-bearing animals, and for the encouragement and development of fisheries, by the Executive order of March 3, 1913 (No. 1733), as modified by the Executive order of August 11, 1916 (No. 2442), a reservation comprising the islands, peninsulas, and lands adjoining the eastern end of the reservation established by the said Executive order of March 3, 1913, and extending in an easterly and northerly direction from Isanotski Strait to a line extending from low-water mark at Foggy Cape on the eastern end of Sutwik Island to low-water mark at Cape Menshikof on the northern shore of the Alaska Peninsula, including the Shumagin Islands and all other islands, peninsulas, or parts thereof within the described area is hereby set apart as a preserve to more effectively insure the protection of the fisheries and for their encouragement and development. This latter reservation is to be known as the Alaska Peninsula Fisheries Reservation.

It is hereby further ordered that all straits, bays, and other waters over which the United States has jurisdiction by reason of their relation and proximity to the islands, peninsulas, and other lands to which this order, as well as the said order of March 3, 1913, applies, be and the same are hereby reserved and set apart also as a preserve to more effectively insure the protection of the fisheries and for their encouragement and development.

The Secretary of Commerce shall have power to make regulations for the proper administration of the said Alaska Peninsula Fisheries Reservation, and the straits, bays, and other waters reserved by this Executive order.

The establishment of the reservations under this Executive order shall not interfere with the use of the waters, islands, or other lands for lighthouse, military, naval, or other public purposes, nor with the use of any of said islands or other lands under the laws of the United States for town-site purposes, mining purposes, or grazing of animals thereupon, under rules and regulations to be established by the Secretary of the Interior.

Under date of April 18, 1922, the Secretary of Commerce issued the following regulations for the administration of the Alaska Peninsula Fisheries Reservation, including the waters of the Aleutian Islands Reservation:

1. For purposes of administration the following six fishing districts are created:

(a) *Port Heiden district*.—Extends along the Bering Sea shores of the reservation from its eastern limit to the one hundred and sixtieth meridian of west longitude.

(b) *Port Moller district*.—Extends along the Bering Sea shores of the reservation from the one hundred and sixtieth meridian of west longitude to the



north entrance of Isanotski Strait (otherwise commonly known as False Pass), which forms its western boundary.

(c) *Ikatan district*.—Includes Isanotski Strait south of its northern entrance, and extends thence along the Pacific shore of the reservation eastward to the one hundred and sixty-first meridian of west longitude.

(d) *Shumagin district*.—Includes the Shumagin Islands and the mainland shores and islands of the Pacific side of the reservation from the one hundred and sixty-first to the one hundred and fifty-ninth meridian of west longitude.

(e) *Chignik district*.—Extends from the one hundred and fifty-ninth meridian of west longitude along the Pacific shores of the reservation to its eastern margin.

(f) *Aleutian Islands district*.—Waters over which the United States has jurisdiction from Isanotski Strait westward throughout the entire Aleutian Islands Reservation.

2. No individual or concern shall engage in the business of catching, canning, or preparing salmon, except for personal or family use and not for sale or barter, within the above-stated districts without first securing a permit from the Secretary of Commerce. Applications for annual permits shall be addressed on or before January 15 of each year to the Secretary of Commerce, Washington, D. C., and shall give full information on the following points: (a) Name and permanent address of person or corporation desiring permit; (b) character of business proposed, whether fishing, canning, salting, or otherwise curing fish; (c) character and extent of plant to be operated and its location; (d) method and extent of fishing proposed; (e) exact place or places where fishing is to be carried on; (f) number and kind of each class of fishing apparatus to be used; (g) number of cases of salmon to be packed (based upon 48 one-pound cans per case) or number of barrels of salmon to be salted or tierces of salmon to be mild cured; (h) when operations are to begin; (i) if application is for continuance of operations formerly conducted, the catch and pack of salmon by species and the amount of each class of gear operated in the next preceding season must be shown; (j) affidavit as to correctness of facts set forth in the application must be made by competent authority.

3. Permits will specify the amount of pack and the character and extent of fishing operations allowed.

4. Permits for the season of 1922 will be issued only to such individuals or concerns as are now operating within the reservation.

5. Permits will be valid only within the district for which issued.

6. Transportation of fresh salmon for canning, salting, or otherwise preserving will not be permitted from one fishing district to another, or outside the reservation.

7. These regulations do not apply to persons taking salmon with rod, hand line, or spear for the personal or family use and not for sale or barter.

8. These regulations will be subject to such annual revision by the Secretary of Commerce as may appear advisable in view of the investigation and the experience of the preceding season.

9. These regulations will be in full force and effect immediately from and after date of issue.

Ten formal permits were issued for the operation of established plants within the reservation, as follows:

No. 47. P. E. Harris & Co.....	Ikatan district.
No. 48. Joint permit to Pacific American Fisheries, Nelson Lagoon Packing Co., Phoenix Packing Co., and Fidalgo Island Packing Co.....	Port Moller district.
No. 49. Everett Packing Co.....	Do.
No. 50. Pacific American Fisheries.....	Ikatan district.
No. 51. Do.....	Do.
No. 52. Shumagin Packing Co.....	Shumagin district.
No. 53. Northwestern Fisheries Co.....	Chignik district.
No. 54. Columbia River Packers' Association.....	Do.
No. 55. Alaska Packers Association.....	Do.
No. 56. George Albert.....	Port Heiden district.

A number of local residents have also been given informal authorization to catch and prepare small lots of salmon, as has been done heretofore.

## SPECIAL STUDIES AND INVESTIGATIONS.

In the season of 1921 a rack was installed in Karluk River and the counting of red salmon passing through to the spawning grounds above was inaugurated. This work is being carried on again in 1922, and a similar experiment has been undertaken in the Chignik River. The data to be thus secured over a series of years in these streams will help to solve problems of great importance to the salmon industry of Alaska, chief among which are the ratio between catch and escapement that will safely maintain the run and the production of salmon under natural conditions from a known escapement.

An investigation of fishery conditions in the Alaska Peninsula Fisheries Reservation was undertaken in the spring of 1922 by a party under the direction of Dr. C. H. Gilbert, of Stanford University. Statistics of the runs of salmon will be secured, and general study and observation of spawning escapement and operations of the companies will be made as a basis for recommendations covering operations in succeeding years.

Statistics of the catch of salmon are also being collected by regular employees on all the chief fishing grounds in Alaska in order to afford more accurate data for the conservation of the industry.

The destruction of predatory fishes was carried on in 1921 by an expedition to Bristol Bay region during the early part of the season, after which attention was directed to patrol of the fishing grounds, and later a survey was made of spawning grounds. Similar work is being done in the season of 1922.

## PROTECTION OF WALRUS AND SEA LIONS.

No changes were made during the year in the walrus and sea-lion regulations issued April 21, 1921, nor were any violations reported.

## NEW LEGISLATION NEEDED.

It has been realized for a number of years that a revision of the act of June 26, 1906, covering the fisheries of Alaska, was urgently necessary. Year after year efforts have been made to secure legislation that would be adequate to meet the new conditions that have developed and enable the department to exercise a proper control over the industry. The present law also refers wholly to the salmon fishery, with practically no application to the important industries that have grown up in the halibut, herring, cod, whale, shrimp, crab, and clam fisheries.

Under the authority granted to the Secretary of Commerce by the act of June 26, 1906, commercial fishing has been prohibited in practically all of the waters of Alaska over which the department has jurisdiction. It is unfortunate, however, that jurisdiction extends only over a zone 500 yards off the mouth of salmon streams, for outside of these waters with modern fishing appliances salmon can be taken with impunity, and practically without any control by the department's representatives, in such a manner as to catch far more than a safe proportion of the run. The results have been the steady and cumulative depletion of the finest fishing localities in Alaska,



and yet the department is powerless to prevent it under the terms of the present law. No authority is given to the Secretary of Commerce to limit the number of plants in a given area or the amount of gear that may be operated by them. In some instances by voluntary agreement those engaged in the industry have limited their packs, basing this action upon information compiled by the bureau showing the critical condition of the fisheries in those sections, but in other cases the shortsighted policy of certain operators prevents a full appreciation of the actual condition of the industry and to an extent nullifies the efforts of the bureau.

Following studies that had been made in 1921 and preceding seasons, the Secretary of Commerce called a conference in November at which Members of Congress, representatives of the salmon industry, the Territorial government of Alaska, the Bureau of Fisheries, and others were present for the consideration of the needs of the fisheries of Alaska and action to be taken for their conservation. As a result of the conference a bill was drafted. A hearing was held before the Committee on the Merchant Marine and Fisheries on H. R. 2394, known as the White bill, then pending in Congress, at which representatives of the fishing industry of Alaska and of the Territorial Fish Commission were present and recommended the substitution for the White bill of the bill prepared following the conference called by the Secretary. Opposition to certain provisions of the substitute bill developed, and it was never introduced. The White bill is still pending in Congress.

The serious depletion of the salmon runs, which has occurred in certain parts of Alaska, has already caused the department to have recourse to the authority of the President for the creation of reserves within which a broader control could be had. It is now contemplated that further use of the powers of the Executive may be requested for the creation of a reserve to the northward and eastward of the Alaska Peninsula Fisheries Reservation covering the great red salmon districts of Bristol Bay and around Kodiak Island, and taking in Cook Inlet in central Alaska. Publicity is being given to these plans in order that the industry may be warned against undue expansions or new projects in the district, and the comments and suggestions of interested persons will be given due consideration.

A great deal of discussion has occurred for a number of years as to legislation needed for the conservation of the halibut industry. The halibut banks lie chiefly beyond the jurisdiction of the countries most interested, and it is realized that efficient protection can be given only through joint efforts of Canada and the United States. The department has submitted to the State Department information as to conditions and needs of this industry and has suggested that a treaty be negotiated with Canada to provide a close season of 90 days annually. It is hoped that this can be accomplished.

#### FUTURE DEVELOPMENT OF ALASKA FISHERIES.

Great development may be expected in some of the fisheries that have heretofore held minor places in the utilization of the aquatic resources of Alaska. The herring fishery made a record production in 1921 and would seem to offer the greatest possibilities

of exploitation. A representative of the bureau in Seattle was detailed to assist the small packers in securing supplies and by giving them valuable instruction as to trade requirements in Scotch-cure herring. Preparations have been made in 1922 for an unusually large pack, which will be prepared principally by the Scotch-cure method introduced by the bureau in 1917 and succeeding seasons through extensive demonstrations at all of the chief herring centers of Alaska. This expansion is due largely to the poor quality of herring that has been received from other sections of the country, which has stimulated efforts of the Alaska packers to supply the ready market offered. Processes should also be developed whereby the small herring can be packed in tin and made a valuable source of food. It seems not beyond the bounds of probability that the herring industry of Alaska may some day rival the salmon industry in importance. Another industry of growing importance, particularly in the southeast district, is the shrimp fishery. The crab fishery also showed a promising development in 1921.

#### ALASKA FUR-SEAL SERVICE.

##### GENERAL ACTIVITIES AT THE PRIBILOF ISLANDS.

The administration of the Pribilof Islands, including the supervision and care of the native inhabitants and the carrying on of operations connected with the valuable fur-seal and blue-fox herds, is steadily growing in importance among the activities of the bureau. The size of the herds of both fur seals and foxes and the large financial return to the Government, as well as the interest of foreign governments in the fur-seal herd, make this a business undertaking of considerable magnitude, requiring the best attention of technically trained and experienced administrators.

The work on the Pribilof Islands is carried on by the bureau's staff of about 15 white employees, with the assistance of the native inhabitants, numbering more than 300 persons. Remuneration for general services rendered by the natives is given in the form of subsistence, including food, fuel, clothing, and miscellaneous supplies, and living quarters, medical attention, and school facilities are furnished by the bureau. A dentist also was at the islands during practically the whole of the fiscal year 1922 for treatment of the natives. The workmen also receive cash payments for taking seal-skins and fox skins and for certain other activities connected with the stations. In addition, from 40 to 50 native workmen from the Aleutian Islands are employed on St. Paul Island during the active sealing season.

Considerable construction work was completed during the year, particularly to provide facilities for washing and blubbering sealskins by the new method and to furnish necessary additional salt-house space. An electric-lighting system was installed and a concrete house for native use was completed on St. George Island. A large shop and a warehouse were also built on St. George Island for handling the increasing catch of fox skins. General repairs were made to buildings on both islands. Attempts by the Navy Department to drill an



artesian well on St. Paul Island were again unsuccessful. Work on laying out the water system in St. Paul village was continued, and if a supply of artesian water is not secured a series of shallow wells will be utilized or water piped from a pond at some distance from the village. The by-products plant was operated on St. Paul Island.

Transportation of supplies from the States to the Pribilof Islands was accomplished chiefly by the naval radio tender *Saturn*, but cargoes were also sent on the commercial vessels *Oregon*, *Brookdale*, and *Apollo*. Many courtesies in the transportation of passengers and small lots of supplies were also extended by the vessels of the Coast Guard.

The bureau's vessel *Eider* has rendered invaluable service during the year in the transportation of supplies, passengers, and mail between the Pribilofs and Unalaska, eight trips having been made. In addition the vessel went to Kodiak in September for extensive overhauling, returning to Unalaska in December. Three trips were also made to other islands in the Aleutian group to secure laborers for sealing work and to return them to their homes.

#### SEAL HERD.

The 1921 census of the seal herd, taken as of date of August 10, indicated 581,453 animals of all ages, an increase of 28,735 over 1920. The tentative figures for the census of 1922 gave 604,971 animals on the same date, an increase of about 23,518. The number of pups born in 1922 was 185,914. The seals killed from one census date to the next are not included in these figures. The 1922 enumeration was made by Edward C. Johnston, who also made the counts in the preceding year.

In 1921 two runways and towers were constructed to facilitate counting of seals, with such good results that in 1922 instructions were given for the construction of nine on St. Paul Island and one on St. George. Additional concrete markers were placed on the rookeries to separate the areas to be counted from the different tripods. Efforts were made to make as complete a pup count as possible in 1922, an undertaking that is becoming practically impossible because of the number of animals in the herd and the extent of ground covered by the rookeries.

The number of cows per harem in 1921 was 45; in 1922 the average was 52.19.

The matter of methods of taking the seal census and determining quotas of animals that may properly be killed for their skins has been receiving most careful consideration by the bureau. In line with the effort to secure all available information in regard to the life history of the fur seals, a party headed by the Assistant Secretary of Commerce is making a trip to the Pribilof Islands and other seal islands of the North Pacific Ocean in the summer of 1922 and will make careful studies of the herds at each locality.

Representatives of the bureau have authenticated 525 sealskins legally taken by Indians in the vicinity of Sitka, Alaska, during the spring migration of 1922. Indians also took 1,107 fur-seal skins off the coast of Washington, which were authenticated by the superintendent of the Neah Bay Indian Reservation under authorization

from the department. A patrol of the sealing grounds was maintained by the bureau's vessel *Murre*. Vessels of the Coast Guard carried out the usual extensive patrol during the migration from the waters off the coasts of Oregon and Washington, following the herd to the Bering Sea and patrolling waters adjacent to the Pribilof Islands and Aleutian Islands during the summer.

#### TAKE OF SEALSKINS.

The number of seals killed under governmental supervision on the Pribilof Islands in 1921 was 23,671, of which 22,550 were taken during the regular season ending August 5 and the remainder in the fall and winter. Seals 3 and 4 years old yielded 22,976 of the total number of skins secured.

The quota of seals to be killed during the calendar year 1922 was tentatively fixed at 25,000, all 3-year-old males. At the time of the visit of the Assistant Secretary's party to the Pribilofs in July the quota was increased to 30,000 3-year-old males, of which 25,000 were to be secured on St. Paul Island and 5,000 on St. George. Up to August 5, when killing ceased, 30,260 skins of all ages had been taken. Killings in the fall after October 20 will add a considerable number to this total.

As a result of experimental work carried on at St. Paul Island by representatives of the Fouke Fur Co. a large number of the skins taken are now handled by methods much changed from those formerly in use. In the past the pelts have been removed by the native workmen in the ordinary manner of skinning animals, which at times resulted in cuts or flays that lessened the market value of the skin. Under the new method the knife is used only to slit the skin along the abdomen and to cut around the head and flipper holes. The carcass is then pinned to the ground by means of an iron bar and the pelt is pulled off. The layer of blubber and meat that remains attached is removed when the skin is blubbered by a force of employees detailed from the dressing and dyeing company. The skins are then washed in running sea water and salted. Washing tanks and additional salt-house facilities have been provided to carry on this work.

#### SALES OF SEALSKINS.

In the fiscal year 1922 two public auction sales of fur-seal skins were held at St. Louis. At the sale on September 28, 1921, 10,778 skins brought \$333,772, and on April 3, 1922, 12,198 skins were sold for \$388,288, a total of 22,976 skins and \$722,060. The better grades of skins brought slightly higher prices than in previous sales, but the large number of low-grade skins from the killing of surplus old males kept the average at practically the same as in the sales the preceding year.

At the sale on April 3, 1922, there were also sold 56 sealskins from the Japanese herd on Robben Island, representing the share of the United States in the skins taken in 1920. These 56 skins brought \$1,276.

As a result of the sales of fur-seal skins from the Pribilof Islands in the fiscal year 1922 the sum of \$94,634.16 has been paid to Great



Britain and Japan as their share of skins to which they are entitled under the North Pacific Sealing Convention of 1911.

#### FOXES AND REINDEER.

The herds of blue foxes on the Pribilof Islands maintain themselves naturally to a large extent on the refuse from seal killings and the thousands of sea birds that nest on the islands. Seal carcasses are also stored for feeding during the winter months. Since the resumption of commercial sealing the fox herds have steadily grown and are now a valuable asset to the Government. Foxing operations during the winter of 1921-22 yielded a total of 712 blue and 21 white pelts. Warm weather and high seas during the trapping season interfered seriously with the work, particularly on St. George Island, which has the largest herd, as so much food was available on the beaches that the animals did not come to the traps for food. Over 200 pairs of foxes were marked and released as breeders on St. George Island during the trapping season.

The fox skins taken in the season of 1920-21, numbering 1,125 blues and 14 whites, were sold at public auction in St. Louis September 28, 1921. The price realized was \$109,398, an average of \$96.83 for blue and \$33 for white skins.

An arrangement was also made through the Bureau of Biological Survey for the sale of live blue foxes to natives of the Aleutian Islands for stocking fox farms. Four pairs were thus delivered in September, 1921, payment being made at the rate of \$88.12 per animal, the average received at the last preceding sale of Pribilof fox skins in St. Louis.

The herds of reindeer on the Pribilof Islands have made satisfactory growth since their introduction in 1911. It was estimated at the end of the calendar year 1921 that there were 250 animals on St. Paul Island and 160 on St. George, a total of 410. In addition 53 were killed for food during the year, 19 of which were used on St. George Island.

#### COOPERATION WITH OTHER GOVERNMENT AGENCIES.

The International Committee on Marine Fishery Investigations held two meetings during the year, the first at Boston on November 4, 1921, attended by two representatives of Canada and two representatives of the United States, and the second in Montreal on May 26, 1922, attended by all representatives of the United States and Canada. On neither occasion was it possible for the representative of Newfoundland to be present. This committee, while engaging in no investigations on its own part, serves as a coordinating agency for the marine fishery investigations of the several countries. Through the discussions of work accomplished or in contemplation and the information and suggestions gained in meeting, it is possible for functioning agencies of the several Governments to plan and conduct investigations in a manner more productive of results and more helpful to all concerned.

As in the preceding years the bureau has cooperated with a number of other Government bureaus, as a result of which it has both re-

ceived and extended helpful service. Such relations have been maintained with several bureaus within the department. The Bureau of Standards has rendered assistance in the standardization of instruments and testing of materials under investigation by the bureau. Arrangements have been made with the Bureau of the Census for the collection and exchange of statistical data of the production of fish oils and fishery by-products that are of mutual interest. The Bureau of Foreign and Domestic Commerce has cooperated in the acquisition of information concerning the foreign trade in fishery products.

Through the Consular Service, Department of State, much valuable information has been received concerning the condition of the fisheries in foreign countries, interesting developments respecting them, and the markets for fishery products. Certain of these reports have made the basis for a forthcoming publication on the fish trade of Latin America.

Effective cooperation has been maintained with the National Park Service in the stocking of the streams of the national parks and with the Forest Service in like work in a number of the forest reservations. Through the helpful interest of the Forest Service a brook-trout egg-collecting station is being established in the White Mountain Forest Reservation, which will materially reduce the cost of supplying eggs to a number of the bureau hatcheries.

Helpful relations have been continued with the Bureau of Indian Affairs and the Reclamation Service, and the Geological Survey has assisted this bureau in several instances during the year.

A scientific assistant was detailed for work with the Public Health Service in connection with problems of mosquito control by fishes.

The bureau was indebted to the Navy Department for the transportation of the annual supplies to the Pribilof Islands and to the Coast Guard Service for aid on numerous occasions, particularly in connection with work in Alaska.

#### VESSEL SERVICE NOTES, 1922.

In view of the excessive cost of coal and other operating expenses and the difficulty in securing a trained civilian staff at the salaries available, it was decided to discontinue for the present any attempt to use the steamer *Albatross*. Accordingly she was taken to Woods Hole, Mass., and put out of commission October 29, 1921. The officers and men were detached for regular naval duty and the vessel placed in the custody of the superintendent of the Woods Hole (Mass.) station.

The hydrographic and biological survey of Chesapeake Bay has been completed as far as the steamer *Fish Hawk* is concerned, six round trips of the bay having been made during the fiscal year. The last one was completed May 24, and on June 7 the vessel arrived at Woods Hole, Mass., preparatory to undertaking similar survey of Long Island Sound. The first trip, which was in the nature of a reconnaissance, was begun on June 28. During the fiscal year the *Fish Hawk* steamed 3,181 miles.

No special work was required of the *Halcyon* except during about five months of the year. From July to October her headquarters were at Boothbay Harbor, Me., and for the remainder of the year



at Woods Hole, Mass. During August a cruise was made of 2,143 miles to obtain bottom samples in connection with the hydrographic survey of the Gulf of Maine. The run embraced Nantucket, Browns Bank, and Yarmouth; 118 stations were made. June was taken up with the preparation of appliances for current observations for the same investigation, and on June 30 the *Halcyon* sailed from Woods Hole to begin the work. During March and April the steamer and her crew were engaged in flatfish work at Newport for the Woods Hole (Mass.) station, but practically no cruising was required. In all, the vessel steamed 3,920 miles.

On account of lack of funds the *Phalarope* was operated to but a limited extent, and what little she did was in connection with the Woods Hole laboratory in August, 1921. During July, September, and October the crew was occupied in putting the *Fulmar* in shape and transferring her from Woods Hole to Charlevoix, Mich. The engineer has been detailed to Washington for special duty, and the remainder of the personnel to the Woods Hole (Mass.) station.

The *Gannet* was only required for use in connection with the Boothbay Harbor (Me.) station during March and April, while the flatfish work was going on. In that period, however, she cruised 2,865 miles in 52 days of actual operation. During the balance of the year her officers and crew were detailed to the Boothbay Harbor (Me.) station excepting for May and June, which were spent in overhauling and reconditioning the vessel.

The *Shearwater* is used for fish-cultural work on the Great Lakes, and during the last fiscal year she was only operated 31 days in the fall and 41 days in the spring. She steamed, however, 2,110 miles. There is no statutory crew provided for the vessel, and her operating costs are very reasonable.

The auxiliary schooner *Eider* made eight round trips between Unalaska and the Pribilofs for the purpose of carrying supplies and Government employees and three trips about the Aleutian Islands for other purposes connected with the bureau's work. During October and November the vessel was overhauled at Kodiak. During the year she cruised 6,965 miles.

The *Murre* and *Auklet* carried on the usual fisheries patrol in southeast Alaska during the summer of 1921, and in October were used by the fish-trap inspectors of the War Department. The *Murre* was also placed at the service of the Bureau of Education and Department of Justice in December and January. In February the *Auklet* towed the gas boat *Merganser* to Seattle, where a new engine was installed in the latter. The *Murre* and *Auklet* have both been equipped with 40-horsepower Standard engines, their original ones of 25 horsepower having proved too light.

The gas boats *Petrel* and *Merganser* were placed in the Alaska Fisheries Service the latter part of the fiscal year. During the winter the gas boat *Widgeon* was taken to Seattle from Norfolk on a Navy transport, and at the end of the year was being altered to suit the needs of the bureau. She will be used in southeast Alaska.

In April the purse seine boat *Clatsop* was purchased for \$5,500 and was sent to Bristol Bay for patrol duty. Her name has been changed to *Scoter*.

## APPROPRIATIONS.

The regular appropriations for the support of the bureau for the fiscal year 1922 aggregated \$1,250,430, as follows:

Salaries -----	\$444, 810
Pay, officers and crews of vessels for Alaska service-----	26, 000
Expenses of advisory committee-----	2, 500
Miscellaneous expenses:	
Administration -----	11, 000
Propagation of food fishes-----	400, 000
Maintenance of vessels-----	120, 000
Inquiry respecting food fishes-----	45, 000
Statistical inquiry -----	20, 000
Protecting sponge fisheries-----	3, 000
Protecting seal and salmon fisheries-----	165, 000
Protecting seal and salmon fisheries, deficiency-----	3, 750
Fish hatchery, Wyoming-----	10, 000
Total -----	1, 250, 430

In accordance with law a detailed statement of the expenditures will be submitted.

Respectfully submitted.

HENRY O'MALLEY,  
*Commissioner of Fisheries.*

HON. HERBERT HOOVER,  
*Secretary of Commerce.*





ERRATA.

(Annual Report, Commissioner of Fisheries, 1922.)

Page 24. - Fifteenth line from bottom: the decrease should read these decreases.

Page 25. - Fourth line from top: a decrease of but 1 should read an increase of about 3.

Fifth line from top: 4,925,081,320 should read 5,125,101,320.

Seventh line from top: \$125.57 should read \$120.36.

Table, 10th line from bottom: 84,164,000 should read 208,224,000  
and 316,295,000 should read 440,355,000.

Table, 9th line from bottom: In Eggs column 75,960,000 should be  
inserted and in Total column 290,820,000 should read  
366,780,000.

Table, last line: 868,961,340 should read 1,068,981,340 and  
4,925,081,320 should read 5,125,101,320.

Page 45. - Second line under Seal Herd: 581,453 should read 581,443 and  
28,735 should read 28,725.

Fourth line under Seal Herd: 23,518 should read 23,528.

Page 46. - Second line under Take of Sealskins: 23,671 should read 23,681  
and 22,550 should read 22,560.

Fourth line under Take of Sealskins: 22,976 should read 22,986.







# DEPARTMENT OF COMMERCE.

HERBERT HOOVER, Secretary of Commerce.

## BUREAU OF FISHERIES.

[HENRY O'MALLEY, Commissioner.]

*Chief functions.*—The propagation of useful food fishes, including lobsters, oysters, and other shellfish, and their distribution to suitable waters.

Investigations of fish culture, fish diseases, and for the conservation of fishery resources and the development of commercial fisheries.

The study of the methods of the fisheries and fishery industries and the utilization of fishery products.

The collection of statistics of fisheries.

The administration of the Alaska salmon fisheries, the fur-seal herd on the Pribilof Islands, and the law for the protection of sponges off the coast of Florida.

## BUREAU OF FOREIGN AND DOMESTIC COMMERCE.

[JULIUS KLEIN, Director.]

*Chief functions.*—The compilation of timely information concerning world market conditions and openings for American products in foreign countries secured through commercial attachés and trade commissioners of the Department of Commerce and the foreign service of the Department of State.

The distribution of such information to American business through weekly "Commerce reports," special bulletins, confidential circulars, and the news and trade press.

The maintenance of commodity, technical, and geographical divisions in Washington for the purpose of affording special service to American export industries.

The compilation and distribution of names of possible buyers and agents for American products in all parts of the world and the publication of weekly lists of specific sales opportunities abroad.

The maintenance of 31 district and co-operative offices in that many cities in the United States to expedite delivery of market information to business men and to keep the department advised as to the more urgent requirements of American trades and industries.

The publication of official statistics on the imports and exports of the United States.

## COAST AND GEODETIC SURVEY.

[E. LESTER JONES, Director.]

*Chief functions.*—The survey of the coasts of the United States and its territories and the publication of charts. Among other things, this includes base measure, triangulation, topography, and hydrography; deep-sea soundings, temperature, and current observations; magnetic observations and researches; gravity researches, etc.

The publication of the results of this work in annual reports and in special publications, including charts of coasts and harbors. Tide tables are published annually in advance, as well as other information of use to navigators.

## STEAMBOAT INSPECTION SERVICE.

[GEORGE UHLER, Supervising Inspector General.]

*Chief functions.*—The inspection of vessels, the licensing of the officers of vessels, and the administration of laws relating to such vessels and their officers. The certification of able seamen who form the crews of merchant vessels.

The inspection of vessels, including the types of boilers; the testing of all materials subject to tensile strain in marine boilers; the inspection of hulls and of life-saving equipment.

## BUREAU OF NAVIGATION.

[D. B. CARSON, Commissioner.]

*Chief functions.*—General superintendence of commercial marine and merchant seamen.

Supervision of registration, licensing, numbering, etc., of vessels under the United States flag and the annual publication of a list of such vessels.

The enforcement of the navigation and steamboat inspection laws and the laws governing radio communication, as well as duties connected with fees, refunds, taxes, fines, etc., originating under such laws.

## BUREAU OF STANDARDS.

[S. W. STRATTON, Director.]

*Chief functions.*—The custody of the standards adopted or recognized by the Government.

The construction of standards when necessary. The testing and calibration of apparatus and the comparison of standards used by scientific or other institutions with those in the custody of the bureau.

The determination of the physical constants and the properties of materials.

The testing of materials and the establishment of standards and processes in co-operation with commercial firms or organizations.

The collection and dissemination of information showing approved methods in building, planning, and construction, including building materials and codes and such other matters as may encourage, improve, and cheapen construction and housing.

Studies on simplified commercial practices and the establishment of such practices through cooperative business organizations.

## BUREAU OF LIGHTHOUSES.

[GEORGE R. PUTNAM, Commissioner.]

*Chief functions.*—The establishment and maintenance of lighthouses, lightships, buoys, and other aids to navigation on the sea and the lake coasts and on the rivers of the United States, including Alaska, Hawaiian Islands, and Porto Rico.

The publication of Light Lists, Buoy Lists, and Notices to Mariners, including information regarding all aids to navigation maintained by the Lighthouse Service.

## BUREAU OF THE CENSUS.

[WILLIAM M. STEUART, Director.]

*Chief functions.*—The taking of the decennial census covering population, agriculture, manufactures, mines and quarries, and forest products.

Decennial report on wealth, public debt, and taxation.

Decennial statistics relating to inmates of institutions, including paupers, insane, prisoners, and juvenile delinquents.

A census of agriculture in each middle-centennial year, a biennial census of manufactures, a quinquennial census of electrical public utilities, statistics of marriage and divorce.

Annual financial statistics of State and municipal governments.

Annual statistics of births, deaths, causes of death, etc., in the registration area of the United States.

Quarterly statistics of leaf-tobacco stocks and of production, stocks, and consumption of fats and oils.

Monthly or semimonthly statistics of cotton ginning, cotton stocks and consumption, the production, stocks and consumption of hides and leather, the production of shoes, and of active textile machinery.

The compilation and publication, in the "Survey of Current Business," of monthly commercial and industrial statistics.